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## 1.0 PROJECT OBJECTIVES

1.0.1 The project objective is to design and construct facilities for the military that are consistent with the design and construction practices used for civilian sector projects that perform similar functions to the military projects. For example, a Company Operations Facility has the similar function as an office/warehouse in the civilian sector; therefore the design and construction practices for a company operations facility should be consistent with the design and construction of an office/warehouse building.

### Comparison of Military Facilities to Civilian Facilities

Military Facility	Civilian Facility
Army Fire Stations (AFS)	Fire Station

1.0.2 It is the Army's objective that these buildings will have a 50 year useful life. The design and construction should provide an appropriate level of quality to ensure the continued use of the facility over that time period with the application of reasonable preventive maintenance and repairs that would be industry-acceptable to a major civilian sector project OWNER. The facility design should consider that the Army may repurpose the use of the facility over the 50 year life. The Army's intent is to install products and materials of good quality that meet industry standard average life that corresponds with the period of performance expected before a major renovation or repurpose. The design should be flexible and adaptable to possible future uses different than the current to the extent practical while still meeting the operational and functional requirements defined within. Flexibility is achieved through design of more flexible structural load-bearing wall and column system arrangements. The site infrastructure will have at least a 50-year life expectancy with industry-accepted maintenance and repair cycles. Develop the project site for efficiency and to convey a sense of unity or connectivity with the adjacent buildings and with the Installation as a whole.

1.0.3 Requirements stated in this contract are minimums. Innovative, creative, and life cycle cost effective solutions, which meet or exceed these requirements are encouraged. Further, the OFFEROR is encouraged to seek solutions that will expedite construction (panelization, pre-engineered, etc.) and shorten the schedule. **The intent of the Government is to emphasize the placement of funds into functional/operational requirements. Materials and methods should reflect this by choosing the most economical Type of Construction allowed by code for this occupancy/project allowing the funding to be reflected in the quality of interior/exterior finishes and systems selected.**

## 1.1. SECTION ORGANIZATION

This Section is organized under 6 major "paragraphs".

- (1) Paragraph 1 is intended to define the project objectives and to provide a comparison between the military facility(ies) and comparable "civilian" type buildings.
- (2) Paragraph 2 describes the scope of the project.
- (3) Paragraph 3 provides the functional, operational and facility specific design criteria for the specific facility type(s) included in this contract or task order.
- (4) Paragraph 4 lists applicable industry and government design criteria, generally applicable to all facility types, unless otherwise indicated in the Section. It is not intended to be all-inclusive. Other industry and government standards may also be used, where necessary to produce professional designs, unless they conflict with those listed.
- (5) Paragraph 5 contains Army Standard Design Criteria, generally applicable to all facility types, unless otherwise indicated in the Section.

(6) Paragraph 6 contains installation and project specific criteria supplementing the other 5 paragraphs.



## **2.0 SCOPE**

### **2.1. ARMY FIRE STATIONS (AFS)**

Provide a standard Structural Fire Station to support military firefighters' mission to provide fire protection to installation flightlines and facilities, and fire prevention education and training.

Station size: Satellite

Number of Companies: 2

Emergency Medical Services (EMS): No

Number and type of emergency vehicles to be accommodated: 4

Entrance shelter: Canopy

Provide heating in Apparatus Bays.

## 2.2. SITE:

Provide all site improvements necessary to support the new building facilities. Refer to Paragraph 6.

Approximate area available 2.00 acres

## 2.3. GOVERNMENT-FURNISHED GOVERNMENT-INSTALLED EQUIPMENT (GFGI)

Coordinate with Government on GFGI item requirements and provide suitable structural support, brackets for projectors/VCRs/TVs, all utility connections and space with required clearances for all GFGI items. Fire extinguishers are GF/GI personal property, while fire extinguisher brackets and cabinets are Contractor furnished and installed CF/CI. All Computers and related hardware, copiers, faxes, printers, video projectors, VCRs and TVs are GFGI.

The following are also GFGI items: No Additional Requirements

## 2.4. FURNITURE REQUIREMENTS

Provide furniture design for all spaces listed in Chapter 3 and including any existing furniture and equipment to be re-used. Coordinate with the user to define requirements for furniture systems, movable furniture, storage systems, equipment, any existing items to be reused, etc. Early coordination of furniture design is required for a complete and usable facility.

The procurement and installation of furniture is NOT included in this contract. Furniture will be provided and installed under a separate furniture vendor/installer contract. The general contractor shall accommodate that effort with allowance for entry of the furniture vendor/installer onto this project site at the appropriate time to permit completion of the furniture installation for a complete and usable facility to coincide with the Beneficial Occupancy Date (BOD) of this project. The furniture vendor/installer contract will include all electrical pre-wiring and the whips for final connection to the building electrical systems however; the general contractor shall make the final connections to the building electrical systems under this contract. Furthermore, the general contractor shall provide all Information/Technology (IT) wiring (i.e. LAN, phone, etc.) up to and including the face plate of all freestanding and/or systems furniture desk tops as applicable, the services to install the cable and face plates in the furniture, the coordination with the furniture vendor/installer to accomplish the installation at the appropriate time, and all the final IT connections to the building systems under this contract.

The Government reserves the right to change the method for procurement of and installation of furniture to Contractor Furnished/Contractor Installed (CF/CI). CF/CI furniture will require competitive open market procurement by the Contractor using the Furniture, Fixtures and Equipment (FF&E) package. Reference applicable appendix for Preliminary FF&E Information including furniture dimensions sizes as shown in the Standard Design.

## 2.5. NOT USED

### **3.0 FIRE STATION**

#### **3.1. FUNCTIONAL/OPERATIONAL REQUIREMENTS**

The Fire Station is composed of three main types of functional areas: Apparatus Equipment & Maintenance (the high bay area where the apparatus are stored and support areas), the Living area (the area where the firemen sleep, shower, eat and relax) and the Administrative & Training Area (the area where the offices and training are located along with the only area accessible by the public. Comply with the attached Army Standard for Fire Stations and Army Standard Designs for Fire Stations (Draft) for area and room functional requirements. Generally, the size of the station depends on the class of station, the number of companies housed, the number and types of emergency vehicles housed, and any additional spaces required. The class of station will partially determine the number of spaces required. However, depending on what is currently available on the Installation, some spaces normally reserved for Headquarters stations may be provided in Satellite stations.

##### **3.1.1. Accessibility Requirements**

The Administrative & Training Area in the building is the only area required to be accessible.

###### **3.1.1.1. Site Plan Design and Construction:**

- (a) Provide ABA compliance access from the parking lot to the building.
- (b) Provide two ABA compliant vehicle parking stalls for the fire station for visitor parking.
- (c) Provide vehicle parking signage and pavement markings.
- (d) Facility Design and Construction:
- (e) The main building entrance on the ground level and at least one emergency egress, designed per applicable code, shall be accessible. Electronic exterior door push buttons are not required.
- (f) Provide ABA clearances and door accesses in the main entrance lobby and the entire Administrative & Training areas of the Fire Station Facility.
- (g) Provide a accessible drinking fountain in the lobby.
- (h) Provide accessible public toilet(s), which may be unisex, in the lobby area.
- (i) Do not include provisions outlined within the ABA requirements for the vision or hearing impaired.

##### **3.1.2. CORE AREAS.** Arrange core areas in one or two story configurations as indicated in Paragraph 2 of this Section..

**3.1.2.1. Apparatus Bay Ancillary Functions.** These areas provide support for and are directly related to functions in the Apparatus Bay. These areas should be directly accessible to or a part of the Apparatus Bay.

**3.1.2.2. Telecommunications Room.** This area provides telecommunication support to the entire fire station facility, requiring direct access from the Administrative & Training Area.

**3.1.2.3. Recycle Area.** Provide a space for the collection and storage of recyclables in the fire station facility.

#### **3.2. BETTERMENTS**

**3.2.1.** Provide a floor radiant heating element at each vehicle bay door in colder climates to prevent the door from freezing to the pavement.

- 3.2.2. Provide ceiling fans in the Fitness Room.
- 3.2.3. If natural gas is available, provide a gas connection to an external grill.
- 3.2.4. Clear spans are preferred for the Apparatus Bay.
- 3.2.5. Provide closed circuit television (CCTV) to monitor entry/exit doors.
- 3.2.6. Provide an Intrusion Detection System (IDS) to protect equipment and assets.

### 3.3. SITE PLANNING AND DESIGN

Organize the site to be compatible with the site planning and style of adjacent existing structures. Locate the building to reflect local climatic conditions. For example, provide protection from prevailing winds and glare and orient operable windows to take advantage of summer breezes. Locate the building to take advantage of passive solar heating and day lighting.

3.3.1. Signage. All Army Fire Stations must have a sign placed at the front of the facility which clearly serves as a landmark for the facility. The sign should be placed at eye level. Provide standardized signage systems in compliance with the Area Design Guide to facilitate movement and provide a sense of orientation.

3.3.2. Vehicle Parking/Hardstand. Hardstand areas shall be rigid pavement. Pavement for organizational vehicle areas shall be designed for the heaviest vehicle at the installation.

3.3.3. Oil/Water Separator. Oil/water separators shall be designed in accordance with local codes and standard industry practice for the specific waste stream to be treated. Minimize maintenance requirements and locate oil/water separators to minimize pipe runs, provide vehicular access, and be out of circulation areas.

3.3.4. Parking and Other Access Drives: Access drives to staff and public parking shall not cross the vehicle access drive out of the Apparatus Bay. Locate parking areas so they do not dominate the main entrance and public image of the facility. Comply with UFC 4-010-01 DOD Minimum Antiterrorism Standards for Buildings.

### 3.4. ARCHITECTURE

3.4.1. Architectural Planning. The architectural plan shall accommodate the functional and spatial relationships required for a functionally efficient Fire Station. Building layouts shall recognize the contrasting operational, administrative and residential functional requirements, and the facility shall be designed for the appropriate accomplishment of each function.

3.4.2. Circulation Design Considerations. The interior functional arrangement shall allow for ease of circulation and movement and consider the safety, health and operational efficiency of the occupants. Also, the need for the fire fighters' rapid response to emergency situations shall be recognized. Exterior circulation at the facility shall meet antiterrorism and security requirements and provide safe and efficient vehicular movement.

3.4.3. Building Exterior. Consult the applicable Area Design Guide for the required aesthetic motif and material preferences. Select exterior materials to be attractive, economical, durable and low maintenance. Pre-engineered metal building systems are preferred for their factory finished metal siding and roof panels. Masonry walls are preferred at the ground floor level.

3.4.3.1. The Fire Station shall present a cohesive architectural image and shall comply with Command and Area Design Guide architectural standards. Also, consider the local geographical and cultural environment. Use durable and low-maintenance exterior finishes.

3.4.3.2. Ensure that the main Fire Station entrance is clearly identifiable to discourage visitors from entering the facility through an open Apparatus Bay door. In cold climates, provide a canopy (or a recess) at required egress doors to ensure that doors can completely open without obstruction from snow and ice. Comply with NFPA 80.

#### 3.4.4. Building Interior

3.4.4.1. Construction and finishes (walls, floor, and ceiling) shall support the cohesive image and theme of the facility. A residential, non-institutional character shall be reflected in the living areas of the facility, such as the Day Room and the Dorm Rooms.

3.4.4.2. Durability is extremely important when specifying materials for interior construction and finishes. Fire Stations are occupied 24 hours per day, seven days a week and heavy equipment is regularly handled throughout the facility. Compared to many other facility types, these conditions will lead to greater interior damage being incurred.

(a) Casework: Provide counters, casework, and cabinets of high-quality and durable construction with Premium or Custom finishes per AWI Quality Standards, 8<sup>th</sup> Edition. Casework, cabinet doors, and drawer faces shall be veneer panel core. At a minimum use plastic laminate doors, drawers, and casework faces. Where no water source is present, countertops shall have plastic laminate as a minimum. Where a water source is present, countertops shall be solid surface/solid composite plastics only.

(i) Interior Finishes: Finishes must take into account the intended uses, be highly durable, and meet the requirements listed in NFPA 101 Life Safety Code.

3.4.5. Floors. Provide concrete floors in the Apparatus Bay areas that shall be sloped to the floor trench drains. Provide floor trench drains parallel to the centerline of each vehicle or a continuous trench drain located at the interior side of overhead doors on each side of the Apparatus Bay. Slope trench drain toward the areas where component washing will occur.

3.4.6. Natural Lighting. The preference is for clerestory lighting over the Apparatus Bay area doors, and vision panels in overhead doors. Provide operable windows for natural lighting and ventilation in Administrative & Training Areas, Dorm Rooms, and Day Room/Training Room.

3.4.7. Apparatus Bay Doors. Provide overhead doors (minimum 14 feet wide by 14 feet high) in the exterior wall at each end of each structural bay and (minimum 18 feet wide by 18 feet high) in the exterior wall at each end of each ARFF bay.. Provide overhead doors (minimum 10 foot by 10 foot) for Consolidated Bench repair shop.

(a) Locking. Provide overhead doors that are operable from the interior only. Provide doors with a positive locking mechanism that will allow the door to remain open at engine exhaust position, approximately 1 ft above the floor. Coordinate door locking requirements with the using service.

(b) Serviceability. Design repair and Apparatus Bay doors to meet heavy duty loads and high frequency of operation. Conduct testing of deflection and operation of the doors prior to acceptance during construction. Doors shall be provided and installed by a commercial door company having not less than five years of experience in manufacturing, installing, and servicing the size and type of doors provided.

(c) Insulated Doors. The preference is insulated doors for thermal resistance and noise control.

3.4.8. Personnel Doors. Provide exterior personnel doors in the ends of central corridors maintenance areas, and in the circulation bays. Provide steel doors with vision panels, except at storage, janitorial, and latrine areas. Minimum size for personnel doors is 3 feet wide by 7 feet high.

#### 3.4.9. Special Acoustical Requirements

When a Fire Station is located near the flightline, comply with the AICUZ noise reductions for the facility location. If an AICUZ map is not available for the location, an acoustical engineer must conduct an acoustical analysis to determine the exact type and extent of the additional acoustical treatments needed to address aircraft noise.

#### 3.4.10. Finishes

##### 3.4.10.1. Paint

(a) All paints used shall be listed on the "Approved product list" of the Master Painters Institute, (MPI). Application criteria shall be as recommended by Master Painters Institute (MPI) guide specifications for the substrate to be painted and the environmental conditions existing at the project site.

(b) Exterior surfaces, except factory pre-finished material or exterior surfaces receiving other finishes shall be painted with a minimum of one prime coat and two finish coats. Paints having a lead content over 0.06 percent by weight of nonvolatile content are unacceptable. Paints containing zinc-chromate, strontium-chromate, mercury or mercury compounds, confirmed or suspected human carcinogens shall not be used on this project. Exterior paints and coating products shall be classified as containing low volatile organic compounds (VOCs) in accordance with MPI criteria. Application criteria shall be as recommended by MPI guide specifications. Provide an MPI Gloss Level 5 Finish (Semi-gloss), unless otherwise specified.

(c) Interior surfaces, except factory pre-finished material or interior surfaces receiving other finishes shall be painted with a minimum of one prime coat and two finish coats. Paints having a lead content over 0.06 percent by weight of nonvolatile content are unacceptable. Paints containing zinc-chromate, strontium-chromate, mercury or mercury compounds, confirmed or suspected human carcinogens shall not be used on this project. Interior paints and coating products shall contain a maximum level of 150 g/l (grams per liter) of volatile organic compounds (VOCs) for non-flat coatings and 50 g/l of VOCs for flat coatings. Provide an MPI Gloss Level 5 Finish (Semi-gloss) in wet areas and a flat finish in all other areas.

##### 3.4.10.2. Minimum Interior Finishes

(a) Designers are not limited to finishes listed in the following table MINIMUM INTERIOR FINISHES and are encouraged to offer higher quality finishes.

(b) Wall, ceiling finishes, floor finishes and movable partitions shall conform to the requirements of the IBC, NFPA and UFC 3-600-01. Where code requirements conflict, the most stringent code requirement shall apply.

(c) Resilient and tile flooring shall be used for floor finishes. If selected, vinyl composition tile (VCT) shall be a minimum 1/8 inch thick, conforming to ASTM F 1066, Class 2, through-pattern tile, Composition 1, asbestos free, with color and pattern uniformly distributed throughout the thickness of the tile.

(d) Flooring shall conform to the Army Standard for Fire Stations and the Army Standard Design for Fire Stations (Draft).

(e) Walls: All wall finish shall be painted gypsum board, except where stated otherwise. Use impact resistant gypsum board in corridors and the centralized laundry, if provided.

(f) All ceiling finishes shall be painted gypsum board, except where stated otherwise.

#### 3.5. STRUCTURAL REQUIREMENTS

Design and construct as a complete system in accordance with APPLICABLE CRITERIA.

### 3.6. MECHANICAL REQUIREMENTS

#### 3.6.1. Fire Protection

Provide automatic sprinklers that provide 100 percent coverage of the facility. Avoid locating any sprinkler piping in spaces that may be subject to freezing. Portions of the sprinkler system subject to freezing may be d sprinkler systems. For the kitchen area(s), provide a wet chemical or water spray for all kitchen hood ductwork. Also, provide each cooking surface with a fire extinguishing system. Ensure the kitchen area(s) are in compliance with NFPA 96.

#### 3.6.2. Plumbing

Provide facility with a fully functional plumbing system that complies with the International Plumbing Code (IPC).

3.6.2.1. Drains: Provide floor trench drains parallel to the centerline of each vehicle or a continuous floor trench drain located at the interior side of overhead doors on each side of the Apparatus Bay. All vehicle bay drains shall connect to an approved oil/water separator with holding tank prior to discharge.

3.6.2.2. Connect all Equipment Wash/ Disinfection and Work Room/ Equipment Maintenance drains to an oil/water separator with holding tank.

3.6.2.3. Connect all Protective Clothing Laundry drains to an oil/water separator with holding tank, if required by location, in accordance with NFPA 1581 Standard on Fire Department Infection Control Program

3.6.2.4. Compressed Air: Provide a compressed air system in the Apparatus Bay with self-retracting lines at each vehicle bay and a separate compressed air system for the Self-Contained Breathing Apparatus (SCBA) Maintenance Room.

3.6.2.5. Hose Bibs: Provide hose bibs near Apparatus Bays for vehicle cleaning and maintenance and at the Patio.

3.6.2.6. Provide an emergency eye wash fountain and shower in the Apparatus Bay and Fire Extinguisher Inspection Room.

3.6.2.7. Provide a foot-operated mop sink with mop hanging rack in the Apparatus Bay.

#### 3.6.3. Heating, Ventilating and Air-Conditioning (HVAC)

Provide facility with a fully functional HVAC system that is automatically controlled by a Building Automation System (BAS).

3.6.3.1. Vehicle Exhaust System: A complete Apparatus Bay Air Cleaning System in compliance with NFPA 1500 Standard on Fire Department Occupational Safety and Health Program to eliminate 100% of vehicle exhaust emissions shall be utilized, consisting of exhaust filtration for apparatus and for off-gassing from Personal Protective Equipment. A hose based, or Fire Apparatus Vehicle Exhaust Removal System (FAVERS) system, may be used in conjunction with the filtration system.

3.6.3.2. SCBA Maintenance Room: Provide positive pressure ventilation in the Self-Contained Breathing Apparatus (SCBA) Maintenance Room to prevent contamination. Provide compressed air lines to the SCBA Maintenance Room.

3.6.3.3. The PPE Gear Storage Room, if provided, shall be negatively pressurized with dedicated exhaust vented to the outside to evacuate gaseous emissions from stored gear or filtration equipment that is designed to filter and remove gaseous emissions from Personal Protective Equipment shall be provided.

3.6.3.4. Dorm Room Pressurization: Positively pressurize the Dorm Rooms with a 100% dedicated outdoor air unit. Dedicated outdoor air units shall continuously supply dehumidified, tempered air to each Dorm Room. Provide compliance with International Mechanical Code (IMC) chapter 4 and maintain slight building positive pressurization. Dedicated outdoor air unit cooling/dehumidification shall be available 24 hours a day/7 days a week/365 days a year. Refer to Paragraph 6 of this section for site specific constraints. Use the outdoor air unit to ventilate and pressurize corridors adjacent to the Dorm Rooms.

3.6.3.5. Dorm Room Temperature Control: Provide each Dorm Room with an individual heating/cooling unit. Centrally control each unit with the facility's Direct Digital Control (DDC) system. Occupant control shall include fan selection (on/off) and a slide bar temperature set point adjustment that allows +/- 2 degrees F of adjustment from the DDC programmed set points (70 degrees F heating, 75 degrees F cooling). Additionally, the DDC controls shall monitor each dwelling unit for sub-cooling. The DDC system shall record an alarm event if the space temperature drops below 71 degrees F (adjustable) when the outside air is greater than 85 degrees F (adjustable).

### 3.7. ELECTRICAL REQUIREMENTS

Electrical power, lighting and telecommunications shall be provided to the facility as specified below, in accordance with APPLICABLE CRITERIA, GENERAL TECHNICAL REQUIREMENTS, all IEEE Standards (including Recommended Practice) where the scope is applicable to this design effort, all UL Standards where the UL scope is applicable to this design effort and where itemized, in the combined interdisciplinary areas cited. Dorm Rooms shall be considered to be living and sleeping rooms; therefore they are considered part of a dwelling unit per NFPA 70 definition.

- (a) Perform a short circuit study as an integral part of selecting and sizing electrical distribution components (all equipment shall be fully rated; that is, do not use series-combination rated equipment).
- (b) Perform a coordination study to ensure that protective device settings are appropriate for the expected range of conditions (depending on the design and construction schedule, it is acceptable to design adequate protective devices with adjustable features, followed by a coordination study required during construction to specify the correct settings.)
- (c) Circuit breakers, disconnect switches, and other devices that meet the OSHA definition of energy-isolating device shall be lockable.
- (d) Do not exceed 5 percent combined voltage drop on feeders and branch circuits if the transformer providing service is located within the facility. If the transformer is located exterior to the facility, limit the combined voltage drop for service conductors, feeders, and branch circuits to 5 percent. Individual voltage drop on branch circuits should not exceed 3 percent. Branch circuits supplying sensitive circuits should be limited to 1 percent voltage drop.
- (e) Unless unavoidable, to minimize sound transmission, do not install "back-to-back" outlet boxes

#### 3.7.1. Exterior Lighting

##### 3.7.1.1. Site Lighting

Provide general site lighting to ensure that parking areas and the exterior facility, including facility aprons, open storage areas, walkways, etc., have adequate lighting for safety, evacuation, and security measures. Exterior area lighting systems should consist of color corrected high intensity discharge lighting units mounted on poles and located within the clear zone and on the primary facility. Illumination levels shall be 50 lux for areas adjacent to the primary facility and 5 lux for parking areas.



3.7.1.2. Perimeter Security Lighting. Protective lighting systems shall be provided in response to project specific requirements to deter trespassers and make them visible to guards. Levels of exterior lighting for protected areas shall conform to the requirements in the IES Lighting Handbook. Lighting circuits shall be controlled by a photoelectric cell with manual override. If the facility is near a flight line, site lighting cannot interfere with or be a distraction to aircraft operations or movement at night.

3.7.1.3. Lighting Controls. Perimeter security lighting protective lighting circuits shall be provided with photocell control with a manual "ON/OFF/AUTO" control switch independent of the control device for the ASHRAE 90.1 nonexempt lighting. The facility aprons and open storage area lighting circuits shall be provided with photocell control with a manual "ON/OFF/AUTO" control switch independent of the control device for the ASHRAE 90.1 nonexempt lighting.

### 3.7.2. Interior Lighting

Provide fluorescent luminaires with premium efficiency electronic programmed start fluorescent ballasts. For spaces where the "Standard Design Criteria, Fire Stations, Room By Room Descriptions" of a space does not specify a particular light level target, the illumination shall be in accordance with the recommendations of the IESNA and other applicable criteria and standards.

3.7.2.1. Illumination target level is 50 foot-candles for the PPE Gear Storage Area, Protective Clothing Laundry, Equipment Maintenance/Wash/Disinfection Area, Fire Extinguisher Inspection, Maintenance and Storage Area (also provide task lighting at work/service bench), Dispatch Area (also provide task lighting at the desk), Day/Training Room (including kitchen), Apparatus Bay and Hose Storage Area. Apparatus Bay lighting design shall incorporate the design elements per UFC 3-530-01 for a Maintenance Facility Vehicle Storage/Repair Area. The illumination is the same for the following rooms if they are included in the project facility: SCBA Maintenance/Compressor room, EMT Storage and Medical Storage Cabinet, Fire Chief's and Deputy Fire Chief's Offices (also provide task lighting at the desk), and Computer Training/Testing Room.

3.7.2.2. Illumination target level is 50 foot-candles for the HAZMAT/CBRNE Equipment Storage Areas, Agent Storage Area, Spare PPE Gear Storage Area, Vehicle Maintenance Equipment Storage Area, Deployment Gear Storage area, and Vending Area.

3.7.2.3. Illumination target level is 0.5 foot-candles for the Outdoor Patio/BBQ Area.

3.7.2.4. Illumination target level of rooms not specified shall be to current codes. Upon conflict current codes shall dictate illumination target levels.

3.7.2.5. Provide dimming controls for the lighting in the Day/Training Room (including kitchen) and Recreation Room.

3.7.2.6. Provide under-cabinet counter lighting where wall cabinets are used above counter tops.

### 3.7.3. Interior Power

3.7.3.1. When facility electrical design includes a 480/277V power distribution system, mechanical systems and lighting systems shall generally be fed from the available 480/277V power distribution system.

3.7.3.2. In general, provide wall duplex outlets, not less than 10 feet on center. Provide not less than one duplex outlet per wall on walls less than 10 feet long. Locate outlets to eliminate the need for extension cords.

3.7.3.3. Above counter receptacles shall be mounted in the vertical wall space above the counter-top.

3.7.3.4. Data, CATV, and similar electronic equipment outlets shall each be provided with an associated duplex receptacle.

3.7.3.5. Provide GFCI outlets in the Apparatus Bays, restrooms, kitchen and water accessible work areas. Provide weatherproof GFCI outlets for all exterior outlets.

#### 3.7.4. Emergency Power

Provide an Emergency Power Supply System (EPSS) in accordance with NFPA 110 for Class X (minimum time 72 hours), Level 1, Type 10. Provide Bypass-Isolation Switches to bypass and isolate the transfer switch. On-site fuel supply shall be provided. Prime movers shall not be solely dependent on a public gas utility for their fuel supply. Means shall be provided for automatically transferring from one fuel supply to another where dual fuel supplies are used. Provide 100% emergency generator back-up power for all Fire Stations.

#### 3.7.5. Special Power Requirements

(a) Apparatus Bay: Provide Apparatus Bay doors with a signaling system to indicate fully raised doors with a red/green indicator located on the driver's side at 6 feet above finished floor. Locate all outlets at 36 inches above finished floor. Provide self-retracting electric drop cords between vehicles that can reach to either end of the bay.

(b) Vehicle Maintenance Bay: Provide vehicle maintenance bay doors with a signaling system to indicate fully raised doors with a red/green indicator located on the driver's side at 6 feet above finished floor. Locate all outlets at 36 inches above finished floor. Provide self-retracting electric drop cords between vehicles that can reach to either end of the bay.

(c) Hose Storage: Provide dedicated outlets to support drying equipment.

(d) Station Officer's Office/Watch Desk: Provide outlets as needed to support the extensive equipment required. Provide two additional quad outlets at the control center console. Provide a switch controlling operation of Apparatus Bay doors.

(e) Telecommunications Room: Provide outlets as needed to support the extensive equipment required. In addition, provide two spare quad outlets. In addition to providing generator backup power for the computer file server and for all dispatch and alarm systems, provide uninterrupted power supply (UPS) that will provide uninterrupted flow of power to gap between the time of power loss and the time that the generator is providing power. Provide transient voltage surge suppression in the electric panel(s) serving this room. Provide a Stored Energy Power Supply System (SEPSS) UPS in accordance with NFPA 111 for Type O, Class 0.25, Category B, Level 1.

(f) Kitchen: Provide dedicated outlets to accommodate all non-portable kitchen equipment.

(g) Fitness Room: Provide dedicated wall or floor outlets as needed to accommodate fitness machines such as treadmills, bikes and stair-step machines. Provide dedicated circuit to accommodate the sauna's heating element.

(h) Laundry Room: Provide additional outlet at the folding table.

(i) Recreation Room: Provide additional outlets(s) to accommodate game equipment. Refer to Paragraph 6.0 of this Section for the number of game equipment to be provided.

(j) Vending Area: Provide dedicated power and outlets required by vending machines. Refer to Paragraph 6.0 of this Section for the number of vending machines to be provided.

(k) Department Training Room: Provide direct power to each work table.

(l) Computer Training/Testing Room: Provide direct power to each computer/study corral and for other equipment such as printers.

(m) Dispatch and Station Officer's Office/Watch Desk: Provide UPS for all dispatch room systems. The UPS shall provide an uninterrupted flow of power to gap between the time of power loss and the time

that generator is providing power. Provide outlets as needed to support all equipment, including charging equipment for handhelds. Provide switch controlling "open only" operation of Apparatus Bay doors. Provide simultaneous light and audible control for the following elements when the firefighter alert system is activated: Dorm Room lights (the dedicated alert light), corridor lights from Dorm Rooms to Apparatus Bay and the Apparatus Bay lights. Provide a Stored Energy Power Supply System (SEPSS) UPS in accordance with NFPA 111 for Type O, Class 0.25, Category B, Level 1.

(n) Outdoor Patio/BBQ: Provide minimum of four weatherproof GFCI outlets (with additional outlets provided as needed to support functional requirements).

(o) Dorm Rooms: Provide a minimum of two duplex outlets at the night table location so that each of the two firefighters who share the room will be capable of plugging in two personal use items at the night table location.

### 3.7.6. Mass Notification

Provide the Mass Notification System (MNS) combined with the Fire Alarm System to prevent duplication of devices and maintenance, which should interface with the installation MNS to provide emergency notifications of an area, regional or national nature. Designer should also consider combining with the Public Address System (PA) for further cost savings.

### 3.7.7. Firefighter Alert System

Firefighter Alert System shall provide visual/audible alerts, features, and controls. Provide simultaneous light and audible control for the following spaces when the firefighter alert system is activated: Dorm Room lights (the dedicated alert light), corridor lights from Dorm Rooms to the Apparatus Bay, and the Apparatus Bay lights. Provide controls for the system at the Station Officer's Office/Watch Desk and at Dispatch Desk. Provide the Fire Chief's and Deputy Fire Chief's Offices with a dedicated alert light fixture that is controllable from the Watch Desk/Dispatch and is tied into the firefighting alert system with a red-tinted bulb or lens.

### 3.7.8. Hazardous Locations

Hazardous locations shall be clearly defined by the designer based on the intended use of the facility and applicable criteria. Receptacles, devices, equipment and wiring in hazardous locations shall be designed (UL listed for the application) and installed in accordance with the NFPA codes. When hazardous locations are determined to be up to 18-inches above the finished floor, receptacles, devices and conduit routing to them shall be installed above the hazardous area or at the height required by the Paragraph 3.7.6.1 Special Power Requirements, whichever is higher.

#### 3.7.8.1. Grounding

The building shall have a ground grid around the perimeter for grounding incoming service, building steel, lightning protection, telephone service, piping, and internal grounding requirements. Provide ground straps as required above and connect to the building grounding system. Provide grounding points in vehicle and equipment parking areas on 40 foot centers (maximum), and coordinate with the power and data bollard units. Additional grounding may be provided based on project requirements.

#### 3.7.8.2. Cathodic Protection System

Corrosion protection for the facility shall be provided by coordinated material specification and/or provision of a cathodic protection system to assure corrosion will not compromise system operation for the 50-year infrastructure design lifetime of the facility. Provide an appropriate cathodic protection system when the design analysis of a corrosion engineer indicates cathodic protection is recommended to assure corrosion will not compromise system operation for the 50-year infrastructure design lifetime of the facility.

### 3.8. TELECOMMUNICATIONS REQUIREMENTS

Telecommunications design shall be in accordance with the Technical Guide for Installation Information Infrastructure Architecture (I3A). In the I3A Technical Criteria, the word "shall" shall be substituted for the word "should" throughout the document.

#### 3.8.1. Service

Coordinate service with local Network Enterprise Center (NEC) personnel.

#### 3.8.2. System

Provide a fully operational system from the demarcation point to each outlet.

Coordinate any closed-circuit television (CCTV)/camera systems with the appropriate Installation security office.

#### 3.8.3. Cable TV (CATV) Requirements

All CATV outlet boxes, connectors, cabling, and cabinets shall conform to the I3A Technical Criteria unless noted otherwise. All horizontal cabling shall be ran from the CATV outlet to the nearest telecommunications room. Provide outlets in Day Rooms, Recreation Rooms and Training areas, and any room specified in the Army Standard Design for Fire Stations (Draft). Provide provisions for programming input to specific outlets from sources in the Telecommunications Room.

#### 3.8.4. Fire Alarm Requirements

There shall be one complete addressable Fire Alarm System for each building. Combine system with MNS and consider incorporating PA system to reduce device and maintenance costs. This system shall consist of a control panel, a communications device, initiating devices, notification devices and associated wiring and pathways. Class A addressable systems shall be installed.

3.8.4.1. All smoke detectors and carbon monoxide detectors shall be monitored. Tampering with a smoke and carbon monoxide detectors shall send a trouble signal to the control panel.

3.8.4.2. All software, software locks, special tools and any other proprietary equipment required to maintain, add devices to or delete devices from the system, or test the Fire Alarm system shall become the property of the Government and be furnished to the Contracting Officers Representative prior to the final inspection of the system.

### 3.9. ATTACHMENTS A THROUGH C

The Attachments represent the Army Standards at the time of award. The Standards may be updated through the course of the contract. Attachment C – The Army Standard Design for Fire Station – Plans are for information only to show general layout and arrangement of the facility. Provide the facility for this project as depicted in the floor plan provided in Appendix J.

Attachment A – The Army Standard for Fire Stations

Attachment B – Standard Design Criteria Fire Stations – Room by Room Description

Attachment C – The Army Standard Design for Fire Station - Plans

Fire Station Space Program Data  
Site Plan  
Floor Plan



DEPARTMENT OF THE ARMY  
ASSISTANT CHIEF OF STAFF FOR INSTALLATION MANAGEMENT  
600 ARMY PENTAGON  
WASHINGTON, DC 20310-0600

DAIM-ZA

APR 9 2010

## MEMORANDUM FOR

Commander, US Army Corps of Engineers (CEMP), 441 G Street NW,  
Washington, DC 20314  
Installation Management Command (IMCOM), 2511 Jefferson-Davis Highway,  
Arlington, VA 22202-3926

SUBJECT: Army Standard for Fire Stations

1. The Army Standard for Fire Stations (encl) is hereby approved for implementation.
2. These standards apply to all Army Components. Only the Assistant Chief of Staff for Installation Management has the authority to approve exceptions to this standard. Waivers from the Army Standard must be approved in accordance with AR 420-1.
3. These standards are mandatory for Military Construction, Army projects in FY13 and beyond and, where feasible, will be incorporated into FY12 projects. Designs based on these Army Standards, Standard Designs, and Design Criteria will be developed consistent with Military Construction transformation methodologies.
4. The chair for the Facilities Design Team (FDT) is Mr. Bill E. Sproul, PE, DAIM-ODC, [William.Sproul1@us.army.mil](mailto:William.Sproul1@us.army.mil), (703) 604-1454. The FDT POC at the USACE Center of Standardization for Fire Stations is Mr. Juan Pace, CEHNC-ED-CS-A, [Juan.R.Pace@usace.army.mil](mailto:Juan.R.Pace@usace.army.mil), (256) 895-1675.

Encl

A handwritten signature in blue ink, appearing to read "Rick Lynch", is positioned above the typed name.

RICK LYNCH  
Lieutenant General, GS  
Assistant Chief of Staff  
for Installation Management



**DEPARTMENT OF THE ARMY**  
**ASSISTANT CHIEF OF STAFF FOR INSTALLATION MANAGEMENT**  
**600 ARMY PENTAGON**  
**WASHINGTON DC 20310-0600**

**The Army Standard for Fire Stations**

**March 2010**

**Description:** The standard Army Fire Station is an emergency respondent facility which supports the needs of military, civilians, soldiers and families during fire and medical emergency situations. The Fire Station is comprised of three main essential elements: **Apparatus Equipment & Maintenance, Administrative & Training, and Living areas.**

**Applicability:**

- The Army Standard applies to Active, Reserve, and National Guard Component facilities on Army Garrisons.
- All United States Army Corps of Engineers (USACE) geographic districts shall incorporate the key mandatory design features described herein in close coordination with USACE Center of Standardization (CoS) for Fire Station facilities.
- The criterion covers all MCA funded Army Fire Station Facilities. The functional relationships are mandatory unless variations are approved by the CoS. The size of the Army Fire Stations shall be based on the mission of the installation. The staff size shall depend on the number of companies in the facility and whether the facility is a Satellite or a Headquarters facility. All projects must be reviewed by the CoS to ensure conformance with the Army Standard.

**Waivers:**

- Only the Assistant Chief of Staff for Installation Management has authority to approve exceptions to the Army Standard.
- Waivers from the Army Standard must be requested in accordance with Army Regulation (AR) 420-1 and the Army Facilities Standardization Program Charter, latest edition.
- All requests for a waiver to the Army Standard require CoS conflict resolution prior to submission by the Garrison Commander.
- Garrison Army Standard waiver request submissions must be received in sufficient time to allow the completion of the Facility Design Team review and development of recommendations or courses of action for the Army Facilities Standardization Committee to consider prior to implementation into project design.
- All waiver requests shall include compelling rationale of functional and operational deviations to include substantiating documentation in sufficient detail for the Army to assess implications of approving the waiver.

## The Army Standard for Fire Stations, March 2010

- All Headquarters, Department of the Army (HQDA) approved waivers shall be documented in installation master plans thereby serving as the installation's modified standards for the facility type affected.
- Late submissions and/or project delays are NOT sufficient stand-alone justification for accelerated review or other dispensation to meeting the Army Standard contained herein.

The Guidance section provides instructions and definitions necessary for the application of the mandatory requirements contained in the tabular section of the Army Standard. As such, they are used in conjunction with the Army Standard in order to ensure the intent and embedded functionality contained herein shall meet the Army's mandatory requirements set forth by this standard.

The Army Standard for Fire Stations is as follows and is based on Army Baseline Standards:

### **THE ARMY STANDARD FOR FIRE STATIONS**

<b>ITEM</b>	<b>MANDATORY CRITERIA</b>
<b>Facility Consolidation</b>	Fire Stations are intended to be stand-alone facilities except when combining a Fire Station with Military Police (MP), Safety, and Directorate of Emergency Services (DES) functions, which is called a DES Facility. An Army Standard has been developed for a DES Facility. No other facility types can be combined with the Fire Station.
<b>Energy and Sustainability</b>	Fire Stations shall be designed to meet energy and sustainable design and development requirements as established by Federal Law and Department of the Army policy.
<b>Planning and Design</b>	This Standard provides guidelines for evaluating, planning, programming, and designing Structural and Aircraft Rescue Fire Fighting (ARFF) Fire Stations. The information in this Standard applies to the design of all new construction projects, to include additions, alterations, and renovation projects in the continental United States (CONUS) and outside the continental US (OCONUS). Alteration and renovation projects shall update existing facilities to meet the guidance and criteria contained in this Standard within budgetary constraints.
<b>Accessibility</b>	The Administrative & Training Areas in the Fire Station are the only areas open to general public and are the only areas within the Fire Station that are required to be Architectural Barriers Act of 1968 (ABA) accessible and shall be in accordance with the latest edition of the Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines, as required by Architectural Barriers Act, title 42 United States Code, sections 4151 - 4157, (42 USC 4151-4157).
<b>Site Selection and Planning</b>	The most critical determinant for the location of a Fire Station is response time. In addition to response time, provide adequate site space to accommodate the fire fighting vehicular turning radii, personnel parking, visitor parking, delivery vehicles, storage requirements, and reserve

## The Army Standard for Fire Stations, March 2010

	vehicles (if applicable). Direct access and response time may conflict with tightening antiterrorism (AT) criteria - ensure that trucks shall not have to cross access control points to reach a target structure or flight line. Facility site shall be prominent and easily visible from the target areas (structures or flight lines).
<b>Vehicular Circulation/Service Road/Drives</b>	Provide site entrances, exits, service drives and any special circulation areas sized to accommodate the largest vehicle that uses the area. Drive through bays shall be utilized. Provide a service road/drive on the side of the building adjacent to the mechanical room. The service drive shall have a controlled access point.
<b>Staff/Visitor Parking</b>	Provide parking for authorized Fire Station staff. Parking area shall be sized to accommodate two shifts. Provide parking for Fire Station visitors. Visitor parking shall be separate from staff parking. Access drives to staff and public parking shall not cross the vehicle access drive out of the Apparatus Bay. Visitor parking spaces shall be approximately 25% of staff parking and shall contain the appropriate number of handicapped accessible spaces as determined by the Architectural Barriers Act of 1968.
<b>Exterior Lighting</b>	Exterior lighting systems shall be provided for parking areas, sidewalks, building entrances and perimeter for safety, evacuation and security measures. If the facility is near a flight line, site lighting shall not interfere with or be a distraction to aircraft movement at night.
<b>Response Time</b>	Refer to Department of Defense (DoD) Instruction 6055.06, <i>DoD Fire and Emergency Services Program</i> to determine required response times.
<b>Patio</b>	Provide outdoor patio space adjacent to the kitchen/dining area, residential in nature, and provide area for firefighters to prepare meals in an outdoor setting that promotes stress reduction and team building. A one or two company station shall have 150 SF and a 3-Company station shall have 250 SF.
<b>Canopy</b>	Provide overhead protection at fire station entrance and when required at egress doors at 40 SF. Canopy area shall be calculated using US Army Technical Instructions 800-01 (TI 800-01), Design Criteria.  As required by geographical location, this area may be required to be a vestibule at 80 SF per vestibule area.
<b>Emergency Generator</b>	Provide 100% emergency generator back-up power for Headquarters and Satellite stations for a 72-hour period.



## The Army Standard for Fire Stations, March 2010

**Primary Facility Scope and Capacity for Standard Structural Fire Station**

The facility sizes below are based on Standard Structural Fire Stations.

**Gross Square Feet (GSF) Deviation:** The facility constructed gross area shall not exceed 105% of the space allocation set forth in this document to accommodate site, construction, or environmental factors.

The number of Apparatus Bays and Dorm Rooms are used to determine the overall size of the Fire Station facility.

A Standard One Company Fire Station includes a two bay apparatus at 4,095 SF net. A Standard Two and Three Company Fire Station includes a three bay apparatus at 5,642 SF net.

Facility Size Classification	Facility Size (GSF)	Apparatus Bay	Number of Emergency Vehicles (See Note 1)	Dorm Rooms (See Note 2)	Staffing (Min.)
One Company Headquarters (HQs)	16,500	2	Up to 4	5	22
One Company Satellite	11,500	2	Up to 4	5	12
Two Company HQs	20,200	3	Up to 6	10	33
Two Company, Two Story HQs	24,600	3	Up to 6	10	33
Two Company Satellite	15,000	3	Up to 6	10	22
Three Company HQs	23,100	3	Up to 6	15	44
Three Company Two Story HQs	27,600	3	Up to 6	15	44
Three Company Satellite	17,500	3	Up to 6	15	32

**Notes:**

1) Total number of Apparatus Bays shall be determined by the authorized number of emergency vehicles based on the current Table of Distribution and Allowance (TDA). One additional bay is authorized for every additional one to two emergency vehicle(s).

2) When Emergency Medical Services (EMS) is authorized based on the current TDA, two (2) additional dorm rooms are authorized.

## The Army Standard for Fire Stations, March 2010

Primary Facility Scope and Capacity for Standard Aircraft Rescue Fire Fighting (ARFF) Fire Station	<p>The facility sizes below are based on Standard ARFF Fire Stations.</p> <p><u>Gross Square Feet (GSF) Deviation:</u> The facility constructed gross area shall not exceed 105% of the space allocation set forth in this document to accommodate site, construction, or environmental factors.</p> <p>The number of Apparatus Bays and Dorm Rooms are used to determine the overall size of the Fire Station facility.</p> <p>A Standard One Company Fire Station includes a two bay apparatus at 4,550 SF net. A Standard Two and Three Company Fire Station includes a three bay apparatus at 6,370 SF net.</p>																																																						
	<table><tr><th>Facility Size Classification</th><th>Facility Size (GSF)</th><th>Apparatus Bay</th><th>Number of Emergency Vehicle (See Note 1)</th><th>Dorm Rooms (See Note 2)</th><th>Staffing (Min.)</th></tr><tr><td>One Company HQs</td><td>17,100</td><td>2</td><td>Up to 4</td><td>5</td><td>22</td></tr><tr><td>One Company Satellite</td><td>12,100</td><td>2</td><td>Up to 4</td><td>5</td><td>12</td></tr><tr><td>Two Company HQs</td><td>21,100</td><td>3</td><td>Up to 6</td><td>10</td><td>33</td></tr><tr><td>Two Company, Two Story HQs</td><td>25,600</td><td>3</td><td>Up to 6</td><td>10</td><td>33</td></tr><tr><td>Two Company Satellite</td><td>15,800</td><td>3</td><td>Up to 6</td><td>10</td><td>22</td></tr><tr><td>Three Company HQs</td><td>24,000</td><td>3</td><td>Up to 6</td><td>15</td><td>44</td></tr><tr><td>Three Company Two Story HQs</td><td>28,500</td><td>3</td><td>Up to 6</td><td>15</td><td>44</td></tr><tr><td>Three Company Satellite</td><td>18,300</td><td>3</td><td>Up to 6</td><td>15</td><td>32</td></tr></table>	Facility Size Classification	Facility Size (GSF)	Apparatus Bay	Number of Emergency Vehicle (See Note 1)	Dorm Rooms (See Note 2)	Staffing (Min.)	One Company HQs	17,100	2	Up to 4	5	22	One Company Satellite	12,100	2	Up to 4	5	12	Two Company HQs	21,100	3	Up to 6	10	33	Two Company, Two Story HQs	25,600	3	Up to 6	10	33	Two Company Satellite	15,800	3	Up to 6	10	22	Three Company HQs	24,000	3	Up to 6	15	44	Three Company Two Story HQs	28,500	3	Up to 6	15	44	Three Company Satellite	18,300	3	Up to 6	15	32
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Layout and Adjacencies	<p>The key internal adjacencies are driven by response time. The locations of the living areas shall accommodate a turn out response time of 60 seconds from the time of dispatch to the Apparatus Bay(s) in the event of an alarm.</p>																																																						
Fire Protection	<p>Fire Station facilities shall be fully protected by automatic fire suppression.</p>																																																						

## The Army Standard for Fire Stations, March 2010

	fire detection, and building alarm systems.
<b>Electrical Design</b>	Provide site electrical utilities, interior distribution systems, communications, and security according to the latest codes and criteria.
<b>Firefighter Alert System</b>	Provide simultaneous light and audible control inside and outside to alert on duty staff of emergencies.
<b>Apparatus, Equipment &amp; Maintenance- (Room Features)</b>	
Apparatus Bay	<ol style="list-style-type: none"> <li>1. The Apparatus Bay(s) shall be properly sized to house authorized emergency vehicles as per the Fire Station's Table of Distribution and Allowance (TDA) for the installation. The size of Apparatus Bays are used to determine the overall area of the Fire Station facility.</li> <li>2. Bays shall be double length and shall be sized according to truck modules of two medium sized trucks. <ul style="list-style-type: none"> <li>▪ A Standard Structural Apparatus for a One-Company Fire Station shall be 45 ft. Wide X 91 ft. long (4,095 SF) net.</li> <li>▪ A Standard Aircraft Rescue Fire Fighting Apparatus for a One-Company Fire Station shall be 50 ft. Wide X 91 ft. long (4,550 SF) net.</li> <li>▪ A Standard Structural Apparatus for a Two and Three-Company Fire Station shall be 62 ft. Wide X 91 ft. long (5,642 SF) net.</li> <li>▪ A Standard Aircraft Rescue Fire Fighting Apparatus for a Two and Three-Company Fire Station shall be 70 ft. Wide X 91 ft. long (6,370 SF) net.</li> <li>▪ An additional Structural bay shall be 17 ft. Wide X 91 ft. Length (1,547 SF) net.</li> <li>▪ An additional Aircraft Rescue Fire Fighting bay shall be 20 ft. Wide X 91 ft. Length (1,820 SF) net.</li> </ul> </li> <li>3. Bays shall be sited to provide ready access for trucks to maneuver into traffic and any major thoroughfare.</li> <li>4. Drive through bays shall be utilized.</li> <li>5. Each bay shall include the following support utility drops for vehicles: air handling/air quality systems, overhead cold water fill, compressed air, cold water, floor trench drain(s), lighting, power, and oil/water separator.</li> <li>6. A complete Apparatus Bay Air Cleaning System shall be utilized consisting of exhaust filtration for apparatus and for off-gassing from Personal Protective Equipment. A hose based or Fire Apparatus Vehicle Exhaust Removal System (FAVERS) system may be used in conjunction with the filtration system.</li> <li>7. Maintain total volume Apparatus Bay air quality within established Regulatory Guidelines for Volatile Organics, Nitrogen Oxide, Sulfur Dioxide, Carbon Monoxide, Particulates, Diesel Exhaust Particulates established by: <ul style="list-style-type: none"> <li>▪ NIOSH- National Institute for Occupational Safety &amp; Health REL</li> </ul> </li> </ol>

## The Army Standard for Fire Stations, March 2010

	<p>(Recommended Exposure Limit/10 Hour Time Weighed Average)</p> <ul style="list-style-type: none"> <li>▪ OSHA- Occupational Safety &amp; Health Administration PELs (Permissible Exposure Limit/ 8 Hour Time Weighed Average)</li> <li>▪ ACGIH- American Conference of Governmental Industrial Hygienists: Threshold Limit Value (Average Over 8 Hour Work Shift)/ Short Term Exposure Limit (Over 15 Minute Period)</li> <li>▪ Latest NFPA 1500 - National Fire Protection Association Standard on Fire Department Occupational Safety and Health Program</li> </ul> <p>8. Provide an oil-water separator with holding tank for waste water from all Apparatus Bay drains.</p> <p>9. Bays shall be heated except in very temperate/tropical climates, but shall not be air conditioned.</p> <p>10. Provide an emergency eye wash fountain and shower, foot operated mop sink with mop hanging rack, and ice machine.</p>
<b>Apparatus, Equipment &amp; Maintenance (Room Features)- (Cont.)</b>	<p><b>The following are areas required to support the Apparatus Bay and shall be included in every Headquarters facility: Station Captain's Suite, Personal Protective Equipment (PPE) Gear Storage, Hose Storage, Self-Contained Breathing Apparatus (SCBA) Maintenance Room, Self-Contained Breathing Apparatus (SCBA) Compressor Room, Protective Clothing Laundry, Equipment Wash/Disinfection, Work Room/ Equipment Maintenance, Emergency Medical Services (EMS) Equipment Storage, Fire Extinguisher Inspection (Flight Line or Non-Flight Line) Maintenance and Storage or Clean-Up Room or PPE Gear Storage Room, and Hazardous Material/Chemical, Biological, Radiological, Nuclear, Explosive Equipment Storage and Spare Personal Protective Equipment Storage.</b></p> <p><b>The following are areas required to support the Apparatus Bay and shall be included in every Satellite facility: Personal Protective Equipment (PPE) Gear Storage, Hose Storage, Self-Contained Breathing Apparatus (SCBA) Maintenance Room, Self-Contained Breathing Apparatus (SCBA) Compressor Room, Protective Clothing Laundry, Equipment Wash/Disinfection, Work Room/ Equipment Maintenance, Emergency Medical Services (EMS) Equipment Storage, and Fire Extinguisher Inspection (Flight Line or Non-Flight Line) Maintenance and Storage or Clean-Up Room or PPE Gear Storage Room.</b></p>
Station Captain's Suite	<p>The Station Captain Office shall only be located in the Headquarters Fire Stations. This typical office space at 120 net square feet shall contain a workstation and private dorm room at 85 net square feet. The dorm room shall have direct access from the Station Captain's office and direct access to the Assistant Chief's Toilet. The Station Captain's office shall be accessible from the Apparatus Bay and an observation window shall be provided to the Apparatus Bay.</p>
Personal Protective Equipment (PPE) Gear	<p>Shall have a locker area to accommodate Personal Protective Equipment. The area shall have an air quality system to filter and remove gaseous</p>

## The Army Standard for Fire Stations, March 2010

Storage (Included in Apparatus Bay Area)	emissions from stored gear and is located along the side walls of the Apparatus Bay. The locker layout shall allow free air circulation around and throughout the clothing. Personal Protective Equipment Gear Storage is located along the side walls of the Apparatus Bay. As required by installation, this area can assigned in place of the Fire Extinguisher Inspection (Flight Line or Non-Flight Line) Maintenance and Storage and shall be accessible from the Apparatus Bay.
Hose Storage (Included in Apparatus Bay Area)	Shall have area for drying and storage of hoses. Hoses are rolled and stored on mobile storage racks and shall be accessible from Apparatus Bay. Hose storage racks are located along the side walls of the Apparatus Bay.
Self-Contained Breathing Apparatus (SCBA) Maintenance Room	Shall have area to service and maintain Self-Contained Breathing Apparatus at 144 net square feet. The room also contains a Mask Pressure Testing Machine. Shall provide area for open shelf storage units. This area shall be accessible from Apparatus Bay and shall have direct access to the Self-Contained Breathing Apparatus Compressor Room.
Self-Contained Breathing Apparatus (SCBA) Compressor Room	Shall have room to house compressor to support the Self-Contained Breathing Apparatus at 50 net square feet. Shall have adequate access to this area for the placement of compressor equipment. This space shall include sound attenuation. A compressed air supply line shall be provided from this room to the Apparatus Bay and Self-Contained Breathing Apparatus Maintenance Room. Shall have direct access from the Self-Contained Breathing Apparatus Maintenance Room.
Protective Clothing Laundry	Shall have laundry facility area to wash and disinfect firefighters' protective clothing. This area shall be accessible from the Apparatus Bay. <ul style="list-style-type: none"> <li>100 net square feet shall be provided for a One and Two-Company Fire Station.</li> <li>150 net square feet shall be provided for a Three-Company Fire Stations.</li> </ul>
Equipment Wash/ Disinfection	Shall have area to wash/disinfect and initiate any minor repair to firefighters' equipment at 150 net square feet. Shall provide area for a work table with adequate lighting and ample storage. Shall provide area for hanging racks and open shelf storage units. This area shall be adjacent to the Work Room/Equipment Maintenance and shall be accessible from the Apparatus Bay. Provide an oil-water separator with holding tank for waste water from all drains.
Work Room/ Equipment Maintenance	Shall have area to maintain and repair firefighting equipment at 120 net square feet. Provide area for a work bench with adequate lighting and ample storage. This room area to be adjacent to the Equipment Wash/Disinfection Area and shall be accessible from the Apparatus Bay. Provide an oil-water separator with holding tank for waste water from all drains.
Emergency Medical Services (EMS) Equipment Storage	Shall have Emergency Medical Services storage area for supplies at 25 net square feet. Emergency Medical Services storage shall be fully conditioned, accessible from the Apparatus Bay and shall be restricted and

## The Army Standard for Fire Stations, March 2010

	controlled. In the Headquarters stations this area shall be located in the Hazardous Material/Chemical, Biological, Radiological, Nuclear, Explosive Equipment Storage area.
(Hazardous Material/Chemical, Biological, Radiological, Nuclear, Explosive Equipment Storage (HAZMAT/CBRNE) and Spare Personal Protective Equipment (SPPE) Storage	<ol style="list-style-type: none"> <li>1. Shall have storage area to house equipment classified for use with hazardous materials. Sufficient open shelf storage areas shall be provided. This area shall be accessible from the Apparatus Bay. <ul style="list-style-type: none"> <li>▪ 240 net square feet shall be provided for a One-Company Fire Station.</li> <li>▪ 360 net square feet shall be provided for a Two-Company Fire Station.</li> <li>▪ 480 net square feet shall be provided for a Three-Company Fire Station.</li> </ul> </li> <li>2. The Hazardous Material/Chemical, Biological, Radiological, Nuclear, Explosive Equipment Storage area shall contain a Logistics Officer area. This area is a typical office space that shall contain a workstation at 80 net square feet.</li> <li>3. In the Headquarters stations, the Emergency Medical Services Equipment Storage shall be located in the Hazardous Material/Chemical, Biological, Radiological, Nuclear, Explosive Equipment Storage area at 25 net square feet.</li> </ol>
Fire Extinguisher Inspection (Non Flight Line) Maintenance and Storage- Option for the Clean-Up Room or the Personal Protective Equipment (PPE) Gear Storage Room	<ol style="list-style-type: none"> <li>1. This area accommodates maintenance and service of fire extinguishers at 160 net square feet. This area shall be accessible from the Apparatus Bay.</li> <li>2. As required by installation mission, this room may be a Clean-Up Room. This area provides showers and lockers for the firemen to decontaminate themselves before entering the living portion of the fire station. A service window shall be provided to the Protective Clothing Laundry room. <ul style="list-style-type: none"> <li>▪ Two private showers w/ changing areas and full privacy doors shall be provided for a One-Company Fire Station.</li> <li>▪ Two private showers w/ changing areas and full privacy doors shall be provided for a Two-Company Fire Station.</li> <li>▪ Three private showers w/ changing areas and full privacy doors shall be provided for a Three-Company Fire Station.</li> </ul> </li> <li>3. As required by the installation's mission, this room may be a Personal Protective Equipment Gear Storage Room. Shall have a locker area to accommodate Personal Protective Equipment. The area shall be kept under constant negative pressure to evacuate gaseous emissions from stored gear or filtration equipment that is designed to filter and remove gaseous emissions from Personal Protective Equipment shall be used. The locker layout shall allow free air circulation around and throughout the clothing.</li> </ol>
Fire Extinguisher (Flight Line) Maintenance and Storage- Option for the Clean-Up	<ol style="list-style-type: none"> <li>1. This area accommodates maintenance and service of fire extinguishers at 160 net square feet. This area shall be accessible from the Apparatus Bay. This area accommodates maintenance and service of flight line fire</li> </ol>

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Room or the PPE Gear Storage Room	<p>extinguishers and includes both an indoor storage/maintenance and an outdoor storage area.</p> <p>2. As required by installation mission, this room may be a Clean-Up Room. This area provides showers and lockers for the firemen to decontaminate themselves before entering the living portion of the fire station. A service window shall be provided to the Protective Clothing Laundry room.</p> <ul style="list-style-type: none"> <li>▪ Two private showers w/ changing areas and full privacy doors shall be provided for a One-Company Fire Station.</li> <li>▪ Two private showers w/ changing areas and full privacy doors shall be provided for a Two-Company Fire Station.</li> <li>▪ Three private showers w/ changing areas and full privacy doors shall be provided for a Three-Company Fire Station.</li> </ul> <p>3. As required by the installation's mission, this room may be a Personal Protective Equipment Gear Storage Room. Shall have a locker area to accommodate Personal Protective Equipment. The area shall be kept under constant negative pressure to evacuate gaseous emissions from stored gear or filtration equipment that is designed to filter and remove gaseous emissions from Personal Protective Equipment shall be provided. The locker layout shall allow free air circulation around and throughout the clothing.</p>
Storage of Structural and Aircraft Rescue Fire Fighting (ARFF) Agent	<p>As dictated by mission requirements with at least one required per department, this area is a single-story structure separate from the fire station building. It shall be located along the drive leading into the Apparatus Bay for ease of loading and unloading of firefighting agents. 75 SF per Aircraft Rescue Fire Fighting truck and 48 SF per structural truck are required for sizing.</p>
Administrative & Training (Room Features)	<p><b>Shall group all the administrative offices and training/support areas of similar function in the same general area and this general area shall be considered the Administrative Office Area.</b></p> <p><b>The following offices shall be identified and included in every Headquarters facility: Provide separate dedicated offices for the Fire Chief, Deputy Fire Chief, Assistant Chief, Training Officer, Assistant Chief for Fire Prevention, Inspector(s), Emergency Medical Services (EMS), and Hazardous Materials (HAZMAT) Safety. In the Inspector(s)' office, there is one inspector per company. Provide a Lobby, ABA Toilet, General Administration Storage, Department Training Room, Computer Training/Testing Room, and Telecommunications Room. All Dispatch and dispatch-like functions shall be grouped together. Dispatch Areas include: Dispatch Supervisor, Dispatch Toilet, and Dispatch Kitchenette, and Uninterrupted Power Source (UPS) Room.</b></p> <p><b>The following offices shall be identified and included in every Satellite facility: Provide separate dedicated office for the Stations Officer's Office/Watch Desk Area with an adjacent UPS Room. Provide a Lobby, ABA Toilet, General Administration Storage, Computer</b></p>

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	<b>Training/Testing Room, and Telecommunications Room.</b>
Fire Chief's Suite	<ol style="list-style-type: none"> <li>1. This typical office space at 200 net square feet shall contain a workstation, private dorm room at 85 net square feet, and private toilet at 60 net square feet. In the private toilet provide water closet, shower, and lavatory. Shall be adjacent to the Deputy Chief's Office and directly off the Lobby. Operable windows shall provide natural light. Anti-terrorism issues, especially in outside the continental US (OCONUS) locations with regard to natural light provisions shall be addressed.</li> <li>2. Independent environmental control shall be provided for the Fire Chief's Office.</li> </ol>
Fire Chief's Conference Room	This area shall provide conference space at 240 net square feet for the station on-duty personnel and provide space for a small conference table for 8 to 10 people. The Fire Chief's Conference Room shall be located off of the corridor in the Administrative Office area.
Deputy Chief's Office	<ol style="list-style-type: none"> <li>1. This typical office space at 120 net square feet shall contain a workstation and be located adjacent to the chief's office and directly off the lobby.</li> <li>2. Independent environmental control shall be provided for the Deputy Chief's Office.</li> </ol>
Station Officer's Office/Watch Desk	<p>This area at 230 net square feet serves to control public access to the station and shall contain a Watch Desk whose function is to receive emergency calls from dispatch. This area contains the security monitors if provided for the station and is occupied 24 hours a day 7 days a week. This area shall have direct access to the apparatus bay and the lobby. Operable windows shall provide natural light. Anti-terrorism issues, especially in outside the continental US (OCONUS) locations with regard to natural light provisions. Independent environmental control shall be provided.</p> <ul style="list-style-type: none"> <li>▪ The UPS room at 60 net square feet is the termination point for all data and communication utilities to support the Station Officer's Office/Watch Desk area only. This room also houses the equipment racks for the Station Officer's Office/Watch Desk area's computer networks, telephone, communication feeds, and an UPS. The UPS room shall be adjacent to and accessible from the Station Officer's Office/Watch Desk area.</li> </ul>
Assistant Chief's Suite	<ol style="list-style-type: none"> <li>1. This typical office space at 120 net square feet shall contain a workstation, private dorm room at 85 net square feet, and private toilet at 60 net square feet. The dorm room shall have direct access from the Assistant Chief's office. In the toilet provide water closet, shower, and lavatory. The toilet shall have access from the Assistant Chief's dorm room and the Station Captain's dorm room. The Assistant Chief area shall be located off of the corridor in the Administrative Office area.</li> <li>2. Independent environmental control shall be provided for the Assistant Chief's Suite.</li> </ol>
General Administration	Shall provide storage at 80 net square feet for general administration and



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Storage	office supplies. Shall be located off of the corridor in the Administrative Office area. Provide built in storage shelving.
Lobby	Shall be at 100 net square feet and serves as the entrance to the facility and be a gathering/waiting space for the visiting public. The lobby is the entrance into the Administrative Office area and shall be recognizable from the outside as a well-lit, inviting space.
Public Toilet	Shall provide an ABA accessible toilet at 48 net square feet with a lavatory and water closet off of the Lobby area.
Dispatch's Suite	<p>1. This room at 256 net square feet functions to receive and dispatch fire related emergency related calls. This room also serves to control public access to the station. This area contains the security monitors for the station and is occupied 24 hours a day, 7 days a week. Provide free access area around the consoles for this room. Provide a dedicated toilet and kitchenette directly adjacent to and accessible from the room for staff use. Provide tinted windows. If possible, operators shall be able to see exterior conditions. Antiterrorism issues, especially in outside the continental US (OCONUS) locations with regard to natural light provisions shall be addressed. This area shall have direct access from the lobby.</p> <ul style="list-style-type: none"> <li>▪ A workstation area shall be provided for a Dispatch Supervisor. The Dispatch Supervisor shall be located in the Dispatch area.</li> <li>▪ Shall provide ABA accessible toilet at 48 net square feet with a lavatory and water closet adjacent to and accessible from the Dispatch area for staff use.</li> <li>▪ Shall provide kitchenette at 20 net square feet with a kitchen sink and disposal adjacent to and accessible from the Dispatch area for staff use.</li> <li>▪ The UPS room at 60 net square feet is the termination point for all data and communication utilities to support the Dispatch area only. This room also houses the equipment racks for the Dispatch area's computer networks, telephone, communication feeds, and an UPS. The UPS room shall be adjacent to and accessible from the Dispatch area.</li> </ul> <p>2. Independent environmental control equipment shall be provided for the Dispatch Suite.</p>
Telecommunications Room	Shall provide a preferably centrally located room at 180 net square feet for the termination of all data and communication utilities in the facility. There shall be a minimum of one Telecommunications Room on each floor, designed in accordance with I3A Guide and ANSI/EIA/TIA-569-B.
Assistant Chief for Fire Prevention's Office	This typical office space at 120 net square feet shall contain a workstation located adjacent to and accessible from the Inspectors' Office area or accessible from the corridor in the Administrative Office area.
Inspector(s)' Office	This typical office space contains workstations for the Fire Inspectors located adjacent to and accessible to the Assistant Chief for Fire

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	<p>Prevention's Office. This area shall be located off of the corridor in the Administrative Office area.</p> <ul style="list-style-type: none"> <li>▪ 144 net square feet shall be provided for a One-Company Fire Station.</li> <li>▪ 288 net square feet shall be provided for a Two-Company Fire Station.</li> <li>▪ 432 net square feet shall be provided for a Three-Company Fire Station.</li> </ul>
Training Officer's Office	This typical office space at 100 net square feet shall contain a workstation. Observation windows shall be provided to the Computer Training/Testing Room and Department Training Room to monitor and control access. This area shall be located off of the corridor in the Administrative Office area.
Department Training Room	<p>1. Shall provide a room for continuing education and training. This area shall be located off of the corridor in the Administrative Office area. Access to the room shall be controlled by the Training Officer. Operable windows shall provide natural light. Anti-terrorism issues, especially in outside the continental US (OCONUS) locations with regard to natural light provisions shall be addressed.</p> <ul style="list-style-type: none"> <li>▪ 420 net square feet shall be provided for a One-Company Fire Station.</li> <li>▪ 700 net square feet shall be provided for a Two-Company Fire Station.</li> <li>▪ 980 net square feet shall be provided for a Three-Company Fire Station.</li> </ul> <p>2. Shall provide a separate room at 80 net square feet for storage of audiovisual equipment, media, and additional equipment and furnishings adjacent to and with direct access from the Department Training Room.</p> <p>3. Independent environmental control shall be provided for the Department Training Room.</p>
Computer Training/Testing Room	<p>1. Shall provide a room at 190 net square feet for Computer Training and Testing consisting of carrels for study and testing. This area shall be located off of the corridor in the Administrative Office area.</p> <p>2. In Headquarters Stations, access to the room shall be controlled by the Training Officer.</p> <p>3. Independent environmental control shall be provided for the Computer Training/Testing Room.</p> <p>4. In Satellite Stations, this room may be an Inspector(s)' Office as required by the installation's mission.</p>
Emergency Medical Services (EMS) Office	This typical office space at 80 net square feet shall contain a workstation. This area shall be located off of the corridor in the Administrative Office area.
Hazardous Materials	This typical office space at 120 net square feet shall contain a workstation. This area shall be located off of the corridor in the Administrative Office

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(HAZMAT) Safety Office	area.
Living (Room Features)	<p><b>Shall group all the sleeping and living areas of similar function in the same general area. This general area shall be considered the Living Area.</b></p> <p><b>The following rooms shall be identified and included in the Living Area of every Headquarters facility: Day/Training Room, Recreation Room, Janitor's Closet, Dorm Rooms, Laundry Room, Bathroom/Showers/Changing, Additional Toilet/Shower, and Fitness Room.</b></p> <p><b>The following rooms shall be identified and included in the Living Area of every Satellite facility: Day/Training Room, Janitor's Closet, Dorm Rooms, Laundry Room, Bathroom/Showers/Changing, and Fitness Room.</b></p>
Day/Training Room	<p>Shall be configured like a large residential kitchen/dining/living room. Shall be flexible to accommodate various functions such as informal meetings and group training for the number of companies on duty. Kitchen shall be sized to provide ample room for meal preparation for the entire facility's overnight population. All kitchen appliances shall be light commercial grade. Operable windows shall provide natural light. Anti-terrorism issues, especially in outside the continental US (OCONUS) locations with regard to natural light provisions shall be addressed. Separate dry and cold food storage shall be provided for each shift. Access shall be off the corridor of the Living Area and shall have direct access to the outdoor Patio.</p> <ul style="list-style-type: none"> <li>▪ 648 net square feet shall be provided for a One-Company Fire Station.</li> <li>▪ 1,296 net square feet shall be provided for a Two-Company Fire Station.</li> <li>▪ 1,944 net square feet shall be provided for a Three-Company Fire Station.</li> </ul>
Dorm Rooms	<p>1. Shall provide private quarters for the firefighters' sleeping duty shifts that promote comfort and relaxation. Each room shall be shared by two firefighters of different crew/shifts so that the room is never occupied simultaneously. Access shall be from the Living Area's corridor and operable windows shall provide natural light in every dorm room. Anti-terrorism issues, especially in outside the continental US (OCONUS) locations with regard to natural light provisions shall be addressed.</p> <ul style="list-style-type: none"> <li>▪ Five (5) Dorm Rooms at 700 net square feet total shall be provided for a One-Company Fire Station.</li> <li>▪ Ten (10) Dorm Rooms at 1,400 net square feet total shall be provided for a Two One-Company Fire Station.</li> <li>▪ Fifteen (15) Dorm Rooms at 2,100 net square feet total shall be provided for a Three-Company Fire Station.</li> <li>▪ Two (2) Dorm Rooms at 280 net square feet total shall be provided for an EMS requirement based on the Table of Distribution and Allowance (TDA).</li> </ul>

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	<p>2. Space shall be provided for individual wardrobes, beds and nightstands in each dorm room.</p> <p>3. Acoustical privacy between rooms shall be provided.</p> <p>4. Independent environmental control shall be provided for each Dorm Room.</p>
Bathroom/Showers/Changing	<p>Provide a separate men's and women's Bathroom/Showers/ Changing Area. Bathroom/Showers/Changing area shall contain private water closets, lavatory and shower stalls with private changing areas for firefighters. Access shall be off the corridor of the Living Area.</p> <ul style="list-style-type: none"> <li>▪ One-Company Station: Provide 1 water closet, 1 shower, and 1 lavatory for females at 150 net square feet, and provide 2 water closets, 2 showers, and 2 lavatories for males at 250 net square feet.</li> <li>▪ Two-Company Station: Provide 1 water closet, 1 shower, and 1 lavatory for females at 150 net square feet, and provide 4 water closets, 4 showers, and 3 lavatories for males at 325 net square feet.</li> <li>▪ Three-Company Station: Provide 1 water closet, 1 shower, and 1 lavatory for females at 150 net square feet, and provide 4 water closets, 4 showers, and 4 lavatories for males at 350 net square feet.</li> </ul>
Fitness Room	<p>1. Shall provide a room at 437 net square feet to accommodate fitness machines, treadmill, stationary bicycle, elliptical machine, free weights and mats. Room shall be sized to provide free circulation and shall be adjacent to, or in the proximity of, the Bathroom/Showers/Changing area. Access shall be off the corridor of the Living Area.</p> <p>2. Independent environmental control shall be provided for the Fitness Room.</p>
Additional Toilet/Shower	<p>This area shall be a toilet at 60 net square feet with a lavatory, water closet, and shower. Access shall be off the corridor of the Living Area.</p>
Laundry Room	<p>Shall provide a room to accommodate large heavy duty commercial washers and dryers, built-in laundry-folding table and wall-mounted drying rack for the firefighters' personal use. Provide direct dryer exhaust to the exterior of the building. Access shall be off the corridor of the Living Area.</p> <ul style="list-style-type: none"> <li>▪ Provide area at 80 net square feet for one washer and two dryers for a One-Company Fire Station.</li> <li>▪ Provide area at 160 net square feet for two washers and two dryers for a Two-Company Fire Station.</li> <li>▪ Provide area at 240 net square feet for three washers and three dryers for a Three-Company Fire Station.</li> </ul>
Janitor's Closet	<p>Provide a Janitor's closet at 48 net square feet. Provide exhaust ventilation directly to the outside. This room shall be off the corridor of the Living Area and near the Bathroom/Showers/Changing area. An additional Janitor's Closet shall be off the corridor of the Living Area near the Day/Training</p>

	Room in the Two-Story Fire Station.
Recreation Room	<p>Provide a Recreation Room at 240 net square feet in a Headquarters station to accommodate up to two "game units", such as pool tables, foosball tables, ping pong tables or video game consoles. Access shall be off the corridor of the Living Area.</p> <ul style="list-style-type: none"><li>▪ As dictated by Installation mission requirements this area shall become additional Day/Training Room area.</li></ul>
Vending	<p>Shall provide space at 40 net square feet for two or more vending machines for snacks and drinks. Vending area shall be conveniently located for use of the firefighters and the fire station staff. Vending shall not be located in the Day/Training Room or Lobby.</p>
Net to Gross Factor	<p>The net-to-gross factor accounts for circulation space, Mechanical Room, Electrical Room, and wall thicknesses. The net-to-gross multiplier for Fire Stations is as follows:</p> <ul style="list-style-type: none"><li>▪ The net-to-gross multiplier for a One-Story Fire Station is 22%.</li><li>▪ The net-to-gross multiplier for a Two-Story Fire Station is 30%.</li></ul>

**GUIDANCE SECTION**

CATEGORY CODE	DESCRIPTION
73010	Fire Station

1. **General Design Philosophy:** The Standard Army Fire Station is a comprehensive facility designed to support the military firefighters' mission to protect lives, installation facilities and flight-lines. The facility also accommodates the firefighters' administrative functions and provides an environment for fire prevention education and training.

2. **General Layout:** The square feet and overall size of each Fire Station shall vary in accordance to specific functional components collocated in each facility. The key internal adjacencies are driven by response time. The number, size, and configuration of emergency vehicles necessary to meet the mission of the specific installation are crucial to the sizing of the apparatus bay. OCONUS fire stations may require larger space allocations due to host nation requirements. Special requirements must be coordinated with the CoS Huntsville. Site constraints may drive the need for a two-story structure. Ensure the appropriate adjacencies are maintained for a two-story structure so that the required response times may be achieved. The Administrative & Training areas shall be placed on the first floor.

3. **Fire Station Master Planning:** The Fire Station shall be easily accessible by military personnel, military personnel family members, and reservists and layouts are driven by response time. The Fire Station shall be sited a minimum of 45 meters (150') from the perimeter of the installation and 25 meters (82') from trash containers, roadways and parking lots. If these standoff distances are not provided, the Fire Station shall be hardened as described in the "DoD Antiterrorism Minimum Standards for Buildings". Reference: UFC 4-010-01 Unified Facilities Criteria – DOD Antiterrorism Minimum Standards for Buildings. Site to be compatible with the site planning and style of adjacent existing site.

4. **Signage:** As a minimum the facility shall be identified as a "Fire Station". Coordinate the signage with the Installation Design Guide (IDG) standards. The installation or community name or geographic location of the facility may be used for public identification purposes. Location of the sign is a site adaptation issue.

5. **Interior Signage:** Provide room identification signage and similar type signs for all rooms. Coordinate the signage with the Installation Design Guide.

6. **Exterior Construction:** Use sustainable, low maintenance finish materials. Coordinate the exterior finishes with the Installation Design Guide. Building to be compatible with the architecture of adjacent existing structures.

7. **Interior Construction:** Use sustainable, durable, impact resistant, low volatile organic compounds (VOC), low maintenance finish materials. Coordinate the interior/exterior finishes with the Installation design standards. Construction and finishes (walls, floor, and ceiling) shall support the cohesive image and theme of the facility. Design the living areas of the facility, such

## The Army Standard for Fire Stations, March 2010

as the Day Room and the Dorm Rooms, to reflect a residential, non-institutional character. Counters, casework, and cabinets shall be of high-quality and durable construction.

8. Interior Glass: All interior glass must be tempered safety glass and mirrors must be constructed with break-resistant materials.

9. Acoustics: Design the facility to provide a comfortable acoustical environment. Provide comprehensive sound isolation and sound absorption measures for individual spaces as appropriate. Provide acoustical design to prevent sound from noisy spaces such as corridors, toilets, elevator machine rooms, and mechanical rooms from having negative impact on the adjacent spaces.

10. Landscaping: Provide materials natural to the area to limit irrigation and maintenance.

11. Utilities: Use underground utility distribution lines, where feasible.

12. Heating, Ventilating and Air Conditioning (HVAC): The HVAC system(s) shall provide heating and air conditioning subject to geographical requirements for the entire facility, excluding the apparatus bay and mechanical room, which require only heating. Radiant heating shall be used for Apparatus Bay heating and radiant floor heating shall be used under all Apparatus Bay doors in cold climates to prevent the doors from freezing to the pavement. A system with zoning flexibility shall be provided. The mechanical room shall have an exhaust fan.

13. Roofline: Flat roofs are not allowed, unless compatibility with existing structures are required. Provide only slope type roofs with a pitch of not less than 3/12.

14. Exterior Windows: Provide all exterior windows with window treatment allowing manual control of exterior light. Do not provide skylights in any location. Exterior windows are an important element that provides daytime lighting to the overall fire station design.

15. Antiterrorism/Force Protection: Facility shall be evaluated for security requirements in accordance with UFC 4-010-01, DoD Minimum Antiterrorism Standards for Buildings, latest edition.

16. Gross Area Calculation: Gross floor areas are calculated in accordance with the latest edition of US Army Technical Instructions 800-01 (TI 800-01), Design Criteria.

17. Physical Security: Facility shall be evaluated for physical security risks using DA Pamphlet 190-51, Risk Analysis for Army Property. High value equipment stored in these facilities should be secured and accounted for in accordance with Section III of AR 190-51, Security of Unclassified Army Property (Sensitive and Nonsensitive).

18. Recycle Space: Provide an easily accessible area that serves the entire building and is dedicated to the collection and storage of non-hazardous materials for recycling, including at a minimum: paper, corrugated cardboard, glass, plastics, and metals.

19. Patio Space: If an attached awning is provided, refer to NFPA 13 for the fire protection requirements.

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20. Additional Space: Additional facility capability may include an Emergency Operations Center (EOC) situation room (if required by the installation and validated by HQDA), or a host nation employee dayroom as mandated by master labor contracts (MLC) or Status of Forces Agreement (SOFA). The EOC in the head quarters facility is a specialized conference room used in cases of major operations to manage and coordinate rescue and emergency service efforts. It shall be set up to handle planned and ad-hoc meetings and a high volume of telephone and computer communications.

21. Compliance: The Army Standard may identify an Army regulation, technical guide or other written guidance as mandatory criteria. The Corps of Engineers CoS provides the first line compliance to Standard review. The Facilities Design Team in conjunction with the CoS shall resolve any issues where there may be conflicting, unclear, or no compliance measurement threshold. Resolution may require senior leadership guidance or amendment of the Army Standard. The Army Standard is not intended to provide compliance criteria detailed in references, regulations, industry standards, or the standard design.



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## REFERENCE CRITERIA

The designs shall use the latest editions of the following design criteria:

- ADA and ABA Accessibility Guidelines for Buildings and Facilities, July 2004, United States Access Board, <http://www.access-board.gov/ada-aba.htm>
- Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines, ADAAG, United States Access Board, <http://www.access-board.gov/adaag/html/adaag.htm>
- American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) Handbooks and Standards (55, 62.1, 90.1)
- ANSI/EIA/TIA-568, Commercial Building Wiring Standard
- ANSI/EIA/TIA-569, Commercial Buildings Standard for Telecommunications Pathways and Spaces
- Architectural Barriers Act of 1968 (ABA), Public Law 90-480, United States Access Board, <http://www.access-board.gov/adaag/html/adaag.htm>
- AR 380-5, Department of the Army Information Security Program
- AR 405-70, Utilization of Real Property
- AR 415-15, Army Military Construction Program Development and Execution
- AR 420-1, Army Facilities Management
- Army SDD LEED NC Silver Policy
- AWI Quality Standards Illustrated
- DA PAM 415-28, Facility Guide To Army Real Property Category Codes
- DG 1110-3-122, Interior Design Guide
- DoD Instruction 4165.57, *Air Installations Compatible Use Zones (AICUZ)*
- DoD Instruction 6055.06, *DoD Fire and Emergency Services Program*
- E.O. 13423, Technical Guidance for Implementing the Five Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings
- ETL 1110-3-491, Sustainable Design for Military Facilities
- IBC – International Building Code
- IPC – International Plumbing Code
- NFPA 13, Standard for the Installation of Sprinkler Systems
- NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
- NFPA 101, Life Safety Code.
- NFPA 403, Standard for Aircraft Rescue and Fire-Fighting Services at Airports
- NFPA 1221, Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems
- NFPA 1500, Standard on Fire Department Occupational Safety and Health Program
- UFC 3-120-10, Interior Design
- UFC 3-210-05FA, Landscape Design and Planting Criteria
- UFC 3-301-01 Structural Engineering
- UFC 3-400-01 Energy Conservation
- UFC 3-410-01FA, Heating, Ventilating, and Air Conditioning
- UFC 3-410-02A, Heating, Ventilating, and Air Conditioning (HVAC) Control Systems
- UFC 3-420-01, Plumbing Systems.
- UFC 3-450-01, Noise and Vibration Control
- UFC 3-500-10, Electrical Engineering
- UFC 3-530-01, Design: Interior and Exterior Lighting and Controls
- UFC 3-600-01, Fire Protection Engineering for Facilities

### **REFERENCE CRITERIA (Cont.)**

- UFC 4-010-01, DoD Minimum Antiterrorism Standards for Buildings
- UFC 4-023-03, Design of Buildings to Resist Progressive Collapse
- USAISEC, Technical Criteria for the Installation Information Infrastructure Architecture (I3A), latest edition
- USAISEC Technical Guide for the Integration of SECRET Internet Protocol (IP) Router Network (SIPRNET)
- US Army Technical Instructions 800-01 (TI 800-01), Design Criteria
- DA Pamphlet 190-51, Risk Analysis for Army Property
- Section III of AR 190-51, Security of Unclassified Army Property (Sensitive and Nonsensitive)

**Standard Design Criteria  
Fire Stations**60

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**US Army Corps of Engineers  
Engineering and Support Center, Huntsville**

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**STANDARD DESIGN CRITERIA  
FIRE STATIONS**

ONE COMPANY HQ	22 MIN
ONE COMPANY SATELLITE	12 MIN
TWO COMPANY HQ	33 MIN
TWO COMPANY, TWO STORY HQ	33 MIN
TWO COMPANY SATELLITE	22 MIN
THREE COMPANY HQ	44 MIN
THREE COMPANY, TWO STORY HQ	44 MIN
THREE COMPANY SATELLITE	32 MIN

**ROOM BY ROOM DESCRIPTIONS**April 2010

## Standard Design Criteria Fire Stations

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## **Standard Design Criteria Fire Stations**

### **1. General Requirements:**

- The Fire Stations shall be of commercial construction standards.
- The Fire Stations are comprised of three main essential elements: Apparatus Equipment & Maintenance, Administrative & Training, and Living Areas.
- All Fire Stations will have either the Fire Extinguisher Inspection (Non Flight Line/ Flight Line) Room, Clean-Up Room, or PPE Gear Storage Room based on Installation requirements. If a PPE Gear Storage Room is required, the air quality requirements for PPE storage in the Apparatus Bay will no longer be applicable.
- All Fire Station facilities shall be protected by an automatic fires suppression system and full detection system. Provide carbon monoxide (CO) detection in all sleeping and living areas defined as the individual dorm rooms, the dorm room access hallway(s), and the entire day/training room. Activation of detectors shall sound a local alarm. If monitored by the building fire alarm system, CO detectors shall be monitored as a non-latching supervisory alarm initiating device. Activation of CO detectors shall not sound a general building alarm. Provide fire alarm system smoke detectors in the individual dorm rooms and the dorm room access hallway(s) only. Do not provide detection in the apparatus bay or other areas where exhaust fumes may be present. Activation of smoke detectors shall sound a general building fire alarm.
- Walls separating the living and administrative portions of the building from the apparatus bay and maintenance spaces shall be completely sealed to prevent passage of exhaust emissions and the resulting exposure to building occupants and contamination of spaces.
- Provide simultaneous light and audible control for the following spaces when the firefighter alert system is activated: To the outside, Dorm Room dedicated alert lights, corridor lights from Dorm Rooms to the Apparatus Bay, and the Apparatus Bay lights.
- Unless noted otherwise in this document, all ceiling heights shall be a nominal 8'-0". ]
- Unless noted otherwise in this document, interior walls between rooms shall be provided with acoustical batt insulation or other approved system, to obtain an STC rating of at least 40. CAC shall be a minimum of 38.
- Provide steel doors with vision panels except at storage, janitorial, dorm, electrical/mechanical and toilet areas.
- Where exterior windows are provided the following requirements shall be met. Shall comply with ATFP requirements. Salient characteristics include easy to clean and able to withstand continuous use. Individual windows shall be operable and screens shall be provided.
- All interior glass shall be tempered safety glass and mirrors must be constructed with break-resistant materials.
- Mounting height of all electrical outlets will be in accordance with industry standards.
- Unless noted otherwise in this document, all interior flooring material shall be resilient.

**Standard Design Criteria  
Fire Stations**

- In storage rooms where shelves are provided, interior shall be marked with a red line 1 inch in width and located 18 inches below the lowest point of the sprinkler head.
- All caulking used inside the building shall be USDA or NSF approved caulking.
- GFCI outlets shall be installed per electrical code.
- Provide 100% capacity emergency generator back-up power for all Fire Stations.
- Provide mass notification system in accordance with UFC 4-021-01.
- Drive through bays shall be utilized.
- Provide site entrances, exits, service drives and any special circulation areas sized to accommodate the largest vehicle that uses the area. The service drive shall have a controlled access point.
- Based on the electrical design and mechanical/electrical loads, additional electrical room may be added near the apparatus bay and/or second floor. It is the electrical designer responsibility to coordinate with the architectural designer to accommodate additional electrical room square footage requirements and location.

## Standard Design Criteria Fire Stations

### 2. SPACE: Apparatus Bay

- **FUNCTIONAL DESCRIPTION:** The Apparatus Bays house the fire fighting and emergency response vehicles. All bays must accommodate the latest and largest structural and ARFF vehicles. Each bay of the Apparatus Room must include the required support utilities (drops) for vehicles such as exhaust, compressed air, hot and cold water, lighting, and power. Clear spans are preferred for the Apparatus Bays.
- **ADJACENCIES:** Located at the end of Fire Station structure for future expansion. Adjacent to and direct access from Apparatus Bay Support areas and corridor access from Administrative and Living areas.
- **OCCUPANTS:** Fire Station users and Fire fighting and emergency response vehicles storage.
- **MINIMUM AREA:**  
A Standard Structural Apparatus for a One-Company Fire Station shall be 45 ft. Wide X 91 ft. long (4,095 SF) net.  
A Standard ARFF Apparatus for a One-Company Fire Station shall be 50 ft. Wide X 91 ft. long (4,550 SF) net.  
A Standard Structural Apparatus for a Two and Three-Company Fire Station shall be 62 ft. Wide X 91 ft. long (5,642 SF) net.  
A Standard ARFF Apparatus for a Two and Three-Company Fire Station shall be 70 ft. Wide X 91 ft. long (6,370 SF) net.  
An additional Structural bay shall be 17 ft. Wide X 91 ft. Length (1,547 SF) net.  
An additional Structural bay shall be 20 ft. Wide X 91 ft. Length (1,820 SF) net.
- **CEILING HEIGHT:** 16 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide a sealed concrete surface. A non-skid, low-maintenance traffic coating may also be acceptable. Slope floor to trench drains. A base material, appropriate for the flooring material used, is required. Salient characteristics include easy to clean, durable (able to withstand wet conditions, dirty conditions, and be petroleum resistant), easily repairable, easy to maintain, and slip resistant.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Concrete masonry units (CMU). Provide epoxy paints on all wall surfaces. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Ceiling not required; however, consider finishing exposed structure. Coordinate mechanical, electrical and plumbing components. None of the ceiling components can be located below minimum ceiling height.
- **DOORS/FRAME:** Salient characteristics include easy to clean, easy to maintain and repair, and compliance to building codes. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device and vision panel.



## Standard Design Criteria

### Fire Stations

- **PLUMBING:** Provide minimum 3-in. diameter water service with 2.5-in. diameter National Standard Threads ball-valve outlets, one (1) at the front of each bay and one (1) at the rear of each bay. Provide an emergency eye wash fountain and shower. Provide foot-operated mop sink with mop hanging rack. Provide connection for ice machine. Provide standard cold water hose bibb for every two truck bays. Provide floor trench drains to accommodate all vehicles. All apparatus room drains should connect to an approved oil/water separator prior to discharge. If an exterior wash area is provided, size the separator for the total volume and connect the exterior drain to this separator.
- **HVAC:** The Apparatus Bay is typically heated. Maintain 55 F (13 C) minimum temperature except in areas with very mild winter conditions. Determine exceptions on a case-by-case basis based on climatic conditions. The Apparatus Bay will not be air conditioned except through waiver process. In addition to climatic conditions, consider the energy costs and sustainability impacts.

A complete Apparatus Bay Air Cleaning System shall be utilized consisting of exhaust filtration for apparatus and for off-gassing from PPE. A hose based Fire Apparatus Vehicle Exhaust Removal System (FAVERS) system may be used in conjunction with the filtration system.

A Fire Apparatus Vehicle Exhaust Removal System (FAVERS) in compliance with NFPA 1500 to eliminate 100% of vehicle exhaust emissions. A direct vent system that evacuates vehicle exhaust directly to the outside is the preferred FAVERS. Makeup air should be distributed so as to minimize drafts and be introduced above apparatus level since diesel exhaust is heavier than air. In this way, the make-up air flow downward will assist in pushing the exhaust fumes out the Apparatus bay doors when open.

Provide compressed air system on self-retracting lines at each vehicle bay. Consider providing a floor radiant heating element at each bay door in colder climates to prevent the door from freezing to the pavement.

- **FIRE PROTECTION:** Provide per current codes.
- **ELECTRICAL:** Provide outlets per current codes. Locate all outlets at 36 in. above finished floor. Provide self-retracting electric drop cords between vehicles that can reach to either end of the bay. Provide backup power sized to provide full unobstructed operation capability of the apparatus bays. Provide power to each retractable bay door.
- **LIGHTING:** Provide per current codes. Provide energy efficient lighting with instant-start feature. Provide doors with a signaling system to indicate fully raised doors. A red/green indicator should be located on the driver's side at 72 in. above finished floor.
- **COMMUNICATION:**  
CCTV. None required.  
CATV/Internal Video. None required.  
PA/Audio. Provide speakers and horns with visual element.  
Telephone. Provide one line with internal two-way communication.  
Data. Provide data drops as required by equipment.  
Security. None required.
- **ACOUSTICS:** None

## **Standard Design Criteria Fire Stations**

- **CASEWORKS/BUILT-IN EQUIPMENT:** None

- **SPECIAL REQUIREMENTS:**

For Structural bays provide 14 ft. by 14 ft. apparatus bay doors with electric eye and/or automatic reverse device. For ARFF bays provide 18 ft. by 18 ft. doors as recommended by NFPA 403. Even if ARFF vehicles are only intended to be housed on one side of a double bay, provide the 18 ft. by 18 ft. doors on both sides to permit drive through and to allow flexibility of use. Provide manual means to open doors in case of power failure. If solid door panels are used, provide insulated doors. Consider providing doors with radio operated closing devices that can be activated from the vehicle.

Ensure both the internal floor slope and the approach drive slope allow the fire protection vehicles to transition into and out of the Apparatus Bay without bottoming out or without impeding driver sightlines.

## Standard Design Criteria

### Fire Stations

#### 3. **SPACE: Station Captain's Suite** (Headquarters Fire Stations only).

- **FUNCTIONAL DESCRIPTION:** This area includes a typical office space and workstation. An adjacent private bedroom should be directly accessible from the Fire Chief's Office.
- **ADJACENCIES:** Shall be accessible from the Apparatus Bay and an observation window shall be provided to the Apparatus Bay. Shall be adjacent to the Assistant Chief/Shift Supervisor's Suite. The private bedroom shall have direct access to the Assistant Chief/Shift Supervisor's private toilet.
- **OCCUPANTS:** Station Captain.
- **MINIMUM AREA:**  
Station Captain's Suite: 120 SF, Net.  
Private Dorm Room: 85 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Concrete masonry units (CMU) at shared walls with Apparatus Equipment & Maintenance areas. GWB is an allowable material, including a furred application attached to the CMU walls. Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device and the office door with a vision panel.
- **OBSERVATION WINDOW/FRAME:** Salient characteristics include durability. Glass shall be tinted for privacy.
- **PLUMBING:** None.
- **HVAC:** Provide independent thermostat.
- **FIRE PROTECTION:** Provide per current codes. Provide smoke and CO detectors.
- **ELECTRICAL:** Provide outlets per current codes. Multiple electrical and data outlets to be provided to accommodate computers and other office equipment.

## Standard Design Criteria Fire Stations

- **LIGHTING:** Provide per current codes. Provide residential-style fixtures and task lighting at individual desks. In addition to the ambient and task lighting fixtures, provide a dedicated alert light fixture that is controllable from the Watch Desk/Dispatch and tied into the firefighting alert system with a red-tinted bulb or lens.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. Provide one outlet in the office area and one outlet in the bedroom area.
  - PA/Audio. Provide speaker.
  - Telephone. Provide one line with internal two-way communication.
  - Data. Provide data drops as required by equipment.
  - Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None.
- **SPECIAL REQUIREMENTS:** The Station Captain's Suite will be located off of the Apparatus Bay. Walls shared with the Administrative & Training areas are allowed to be of materials other than CMU.

## Standard Design Criteria

### Fire Stations

#### 4. **SPACE: Personal Protection Equipment (PPE) Gear Storage**

- **FUNCTIONAL DESCRIPTION:** This area provides storage for the firefighters' protective gear. A well-ventilated locker is assigned to each member of the firefighting crew. Sufficient floor area in front of each locker is required for easy access during emergencies.
- **ADJACENCIES:** Located along the side walls of the Apparatus Bay. Should be directly accessible from the Apparatus Bay if required to be a room.
- **OCCUPANTS:** Fire Station Staff
- **MINIMUM AREA:** Room: 160 SF, Net. If part of Apparatus Bay, area is included in the Apparatus Bay net area.
- **CEILING HEIGHT:** 8 ft. minimum. If part of Apparatus Bay, shall meet the Apparatus Bay ceiling requirements.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide a sealed concrete surface sloped to drain. A non-skid, low-maintenance traffic coating may also be acceptable. A base material, appropriate for the flooring material used, is required. Salient characteristics include easy to clean, durable (able to withstand wet and dirty conditions), easily repairable, easy to maintain, and slip resistant.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Concrete masonry units (CMU). Provide epoxy paints or industrial latex on all wall surfaces. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panel (ACP) or gypsum wall board (GWB) ceiling with industrial latex or epoxy paint. Salient characteristics include durable and shall provide an aesthetically pleasing surface, free of sags or other defects. If part of Apparatus Bay, shall meet the Apparatus Bay ceiling requirements.
- **DOORS/FRAME:** Salient characteristics include easy to clean, easy to maintain and repair, and compliance to building codes. Doors, frames, and hardware shall be able to withstand constant opening and closing. Doors shall be provided with self-closing device and vision panel.
- **PLUMBING:** A floor drain is required in this area that shall be self priming, or designed to prevent sewer gases from entering the occupied space by a proven and maintenance-free design. If part of Apparatus Bay, provide hose bib.
- **HVAC:** The area shall be kept under constant negative pressure to evacuate gaseous emissions from stored gear to the outside or filtration equipment that is designed to filter and remove gaseous emissions from PPE shall be provided. If part of Apparatus Bay, the area shall have an air quality system to filter and remove gaseous emissions from stored gear.
- **FIRE PROTECTION:** Provide per current codes.

## Standard Design Criteria Fire Stations

- **ELECTRICAL:** Provide outlets per current codes.
- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with fluorescent energy efficient light fixtures.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. None required.
  - PA/Audio. Provide speakers and horns with visual element.
  - Telephone. None required.
  - Data. None required.
  - Security. None required.
- **ACOUSTICS:** None.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None.
- **SPECIAL REQUIREMENTS:** Locker layout should permit free air circulation around and throughout clothing.

## Standard Design Criteria Fire Stations

### 5. SPACE: Hose Storage

- **FUNCTIONAL DESCRIPTION:** This area provides for storage of hoses. Hoses are rolled and stored on mobile storage racks.
- **ADJACENCIES:** Located along the side walls of the Apparatus Bay.
- **OCCUPANTS:** Fire Station Staff
- **MINIMUM AREA:** Area is included in the Apparatus Bay net area.
- **CEILING HEIGHT:** Shall meet the Apparatus Bay ceiling requirements.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide a sealed concrete surface sloped to drain. A non-skid, low-maintenance traffic coating may also be acceptable. A base material, appropriate for the flooring material used, is required. Salient characteristics include easy to clean, durable (able to withstand wet and dirty conditions), easily repairable, easy to maintain, and slip resistant.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Concrete masonry units (CMU). Provide epoxy paints or industrial latex on all wall surfaces. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Shall meet the Apparatus Bay ceiling requirements.
- **DOORS/FRAME:** None
- **PLUMBING:** A floor drain is required in this area that shall be self priming, or designed to prevent sewer gases from entering the occupied space by a proven and maintenance-free design. Provide hose bib.
- **HVAC:** Ensure space is well ventilated.
- **FIRE PROTECTION:** Provide per current codes.
- **ELECTRICAL:** Provide outlets per current codes. Dedicated outlets required to support drying equipment (if provided).
- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with fluorescent energy efficient light fixtures.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. None required.
  - PA/Audio. Provide a speaker.
  - Telephone. None required.
  - Data. None required.
  - Security. None required.
- **ACOUSTICS:** None.

## **Standard Design Criteria Fire Stations**

- **CASEWORKS/BUILT-IN EQUIPMENT:** Consider providing hose drying oven in areas where required by climatic conditions.
- **SPECIAL REQUIREMENTS:** Layout should permit free air circulation around the hoses.



## Standard Design Criteria Fire Stations

### 6. SPACE: SCBA Maintenance Room

- **FUNCTIONAL DESCRIPTION:** The Self-Contained Breathing Apparatus (SCBA) Maintenance Room is used for the maintenance and minor repair of the SCBA equipment. It includes a work bench, ample task lighting, and shelving for storage of parts and equipment. The room also contains a Mask Pressure Testing Machine.
- **ADJACENCIES:** Accessible from Apparatus Bay and shall have direct access to the SCBA Compressor Room.
- **OCCUPANTS:** Fire Station Staff
- **MINIMUM AREA:** 144 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide a sealed concrete surface sloped to drain. A non-skid, low-maintenance traffic coating may also be acceptable. A base material, appropriate for the flooring material used, is required. Salient characteristics include easy to clean, durable (able to withstand wet and dirty conditions), easily repairable, easy to maintain, and slip resistant.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Concrete masonry units (CMU). Provide epoxy paints or industrial latex on all wall surfaces. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panel (ACP) or gypsum wall board (GWB) ceiling with industrial latex or epoxy paint. Salient characteristics include durable and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include easy to clean, easy to maintain and repair, and compliance to building codes. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device and vision panel.
- **PLUMBING:** A floor drain for condensate is required in this area that shall be self priming, or designed to prevent sewer gases from entering the occupied space by a proven and maintenance-free design.
- **HVAC:** The area shall be kept under constant negative pressure to evacuate gaseous emissions from stored gear to the outside or filtration equipment that is designed to filter and remove gaseous emissions from equipment shall be provided. Provide any additional ventilation requirements for compressor equipment.
- **FIRE PROTECTION:** Provide per current codes.
- **ELECTRICAL:** Provide outlets per current codes. Provide additional outlets and power as required by equipment.

## Standard Design Criteria Fire Stations

- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with fluorescent energy efficient light fixtures. Provide task lighting for the work/service bench.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. None required.
  - PA/Audio. Provide a speaker.
  - Telephone. Provide one line with internal two-way communication.
  - Data. Provide data drops as required by equipment.
  - Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** Provide equipment safety cage and storage shelving.
- **SPECIAL REQUIREMENTS:** None.

## Standard Design Criteria Fire Stations

### 7. SPACE: SCBA Compressor Room

- **FUNCTIONAL DESCRIPTION:** The Self-Contained Breathing Apparatus (SCBA) Compressor Room houses the main compressor unit used to charge the apparatus with filtered air.
- **ADJACENCIES:** Provide direct access to the SCBA Maintenance Room.
- **OCCUPANTS:** Fire Station Staff
- **MINIMUM AREA:** 50 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide a sealed concrete surface sloped to drain. A non-skid, low-maintenance traffic coating may also be acceptable. A base material, appropriate for the flooring material used, is required. Salient characteristics include easy to clean, durable (able to withstand wet and dirty conditions), easily repairable, easy to maintain, and slip resistant.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Concrete masonry units (CMU). Provide epoxy paints or industrial latex on all wall surfaces. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panel (ACP) or gypsum wall board (GWB) ceiling with industrial latex or epoxy paint. Salient characteristics include durable and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include easy to clean, easy to maintain and repair, and compliance to building codes. Doors, frames, and hardware shall be able to withstand constant opening and closing. Doors shall be provided with self-closing device and vision panel.
- **PLUMBING:** Provide compressed air lines to Apparatus Bay and SCBA Maintenance Room. A floor drain for condensate is required in this area that shall be self priming, or designed to prevent sewer gases from entering the occupied space by a proven and maintenance-free design.
- **HVAC:** The area shall be kept under constant negative pressure to evacuate gaseous emissions from stored gear to the outside or filtration equipment that is designed to filter and remove gaseous emissions from equipment shall be provided. Provide any additional ventilation requirements for compressor equipment.
- **FIRE PROTECTION:** Provide per current codes.
- **ELECTRICAL:** Provide outlets per current codes. Provide additional outlets and power as required by equipment.
- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with fluorescent energy efficient light fixtures.

## Standard Design Criteria Fire Stations

- **COMMUNICATION:**  
CCTV. None required.  
CATV/Internal Video. None required.  
PA/Audio. Provide a speaker.  
Telephone. None required.  
Data. None required.  
Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None
- **SPECIAL REQUIREMENTS:** Provide double door access for installation of the main compressor unit to the exterior.

## Standard Design Criteria Fire Stations

### 8. SPACE: Protective Clothing Laundry

- **FUNCTIONAL DESCRIPTION:** Utilized to wash and disinfect firefighters' protective clothing/gear. The room should accommodate large commercial-grade washers and dryers and a drip-dry rack.
- **ADJACENCIES:** Provide direct access through the Apparatus Bay to the exterior. If a Clean-Up Room is provided, the Protective Clothing Laundry Room shall be adjacent to the Clean-Up room and a service window provided.
- **OCCUPANTS:** Fire Station Staff
- **MINIMUM AREA:** One-Company: 100 SF, Net. Two-Company: 180 SF, Net. Three-Company: 150 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide a sealed concrete surface sloped to drain. A non-skid, low-maintenance traffic coating may also be acceptable. A base material, appropriate for the flooring material used, is required. Salient characteristics include easy to clean, durable (able to withstand wet conditions, dirty conditions, and spills related to the chemicals within), easily repairable, easy to maintain, and slip resistant.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Concrete masonry units (CMU). Provide epoxy paints or industrial latex on all wall surfaces. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide moisture resistant acoustical ceiling panel (ACP) or gypsum wall board (GWB) ceiling with industrial latex or epoxy paint. Salient characteristics include durable and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** If doors are provided, salient characteristics include easy to clean, easy to maintain and repair, and compliance to building codes. Doors, frames, and hardware shall be able to withstand constant opening and closing. Doors shall be provided with self-closing device and vision panel.
- **SERVICE WINDOW/FRAME:** Salient characteristics include durability. Only if Clean-Up Room is required in the Fire Station.
- **PLUMBING:** Provide water supply and drain to each washer. A floor drain is required in this area that shall be self priming, or designed to prevent sewer gases from entering the occupied space by a proven and maintenance-free design.
- **HVAC:** The area shall be kept under constant negative pressure to evacuate gaseous emissions from stored gear to the outside or filtration equipment that is designed to filter and remove gaseous emissions from equipment shall be provided.
- **FIRE PROTECTION:** Provide per current codes.

## Standard Design Criteria Fire Stations

- **ELECTRICAL:** Provide outlets per current codes. Provide additional outlets and power as required by equipment.
- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with fluorescent energy efficient light fixtures.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. None required.
  - PA/Audio. Provide a speaker.
  - Telephone. None required.
  - Data. None required.
  - Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None
- **SPECIAL REQUIREMENTS:** None.

## Standard Design Criteria Fire Stations

### 9. SPACE: Equipment Wash/Disinfection

- **FUNCTIONAL DESCRIPTION:** Utilized to clean and disinfect firefighters' protective clothing/gear and equipment when fire trucks return from a fire or other event. It includes a wash-off area where incoming equipment can be washed, desalinated, and dried.
- **ADJACENCIES:** Shall be adjacent to the Work Room/Equipment Maintenance Room and have access from the Apparatus Bay.
- **OCCUPANTS:** Fire Station Staff
- **MINIMUM AREA:** 150 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide a sealed concrete surface sloped to drain. A non-skid, low-maintenance traffic coating may also be acceptable. A base material, appropriate for the flooring material used, is required. Salient characteristics include easy to clean, durable (able to withstand wet conditions, dirty conditions, and spills related to the chemicals within), easily repairable, easy to maintain, and slip resistant.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Concrete masonry units (CMU). Provide epoxy paints or industrial latex on all wall surfaces. Shall use stainless steel wainscot in wash area. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide moisture resistant acoustical ceiling panel (ACP) or moisture resistant gypsum wall board (GWB) ceiling with industrial latex or epoxy paint. Salient characteristics include durable and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** If doors are provided, salient characteristics include easy to clean, easy to maintain and repair, and compliance to building codes. Doors, frames, and hardware shall be able to withstand constant opening and closing. Doors shall be provided with self-closing device and vision panel.
- **PLUMBING:** Provide floor mop sink, with hose and spray nozzle. Provide a minimum three-compartment stainless steel sink and a drip dryer rack. Provide an oil-water separator with holding tank for wastewater from drains. Provide compressed air supply. A floor drain is required in this area that shall be self priming, or designed to prevent sewer gases from entering the occupied space by a proven and maintenance-free design.
- **HVAC:** The area shall be kept under constant negative pressure to evacuate gaseous emissions from stored gear to the outside or filtration equipment that is designed to filter and remove gaseous emissions from equipment shall be provided.
- **FIRE PROTECTION:** Provide per current codes.

## Standard Design Criteria Fire Stations

- **ELECTRICAL:** Provide outlets per current codes.
- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with fluorescent energy efficient light fixtures.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. None required.
  - PA/Audio. Provide a speaker.
  - Telephone. None required.
  - Data. None required.
  - Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None
- **SPECIAL REQUIREMENTS:** None.



## Standard Design Criteria Fire Stations

### 10. SPACE: Work Room/Equipment Maintenance

- **FUNCTIONAL DESCRIPTION:** Utilized to for the minor repair and maintenance of firefighters' equipment.
- **ADJACENCIES:** Shall be adjacent to the Equipment Wash/Disinfection Room and have access from the Apparatus Bay.
- **OCCUPANTS:** Fire Station Staff
- **MINIMUM AREA:** 120 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide a sealed concrete surface sloped to drain. A non-skid, low-maintenance traffic coating may also be acceptable. A base material, appropriate for the flooring material used, is required. Salient characteristics include easy to clean, durable (able to withstand wet conditions, dirty conditions, and spills related to the chemicals within), easily repairable, easy to maintain, and slip resistant.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Concrete masonry units (CMU). Provide epoxy paints or industrial latex on all wall surfaces. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide moisture resistant acoustical ceiling panel (ACP) or moisture resistant gypsum wall board (GWB) ceiling with industrial latex or epoxy paint. Salient characteristics include durable and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** If doors are provided, salient characteristics include easy to clean, easy to maintain and repair, and compliance to building codes. Doors, frames, and hardware shall be able to withstand constant opening and closing. Doors shall be provided with self-closing device and vision panel.
- **PLUMBING:** Provide an oil-water separator with holding tank for wastewater from drains. Provide compressed air supply. A floor drain is required in this area that shall be self priming, or designed to prevent sewer gases from entering the occupied space by a proven and maintenance-free design.
- **HVAC:** The area shall be kept under constant negative pressure to evacuate gaseous emissions from stored gear to the outside or filtration equipment that is designed to filter and remove gaseous emissions from equipment shall be provided.
- **FIRE PROTECTION:** Provide per current codes.
- **ELECTRICAL:** Provide outlets per current codes. Provide additional outlets and power as required by equipment.
- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with fluorescent energy efficient light fixtures. Provide task lighting for work/service bench.

## Standard Design Criteria Fire Stations

- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. None required.
  - PA/Audio. Provide a speaker.
  - Telephone. Provide one line with internal two-way communication.
  - Data. None required.
  - Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None
- **SPECIAL REQUIREMENTS:** None.

## Standard Design Criteria

### Fire Stations

#### 11. **SPACE: EMS Equipment Storage (Including Lockable Medical Cabinet)**

- **FUNCTIONAL DESCRIPTION:** Utilized for the storage of basic first aid supplies. The Lockable Medical Storage Cabinet is often a cabinet or subspace within the EMT Storage area and is for storage of drugs, needles, and other restricted medical supplies. Access to EMT Storage is restricted and controlled to prevent theft and abuse of controlled substances.
- **ADJACENCIES:** Shall be accessible from the Apparatus Bay. The EMS Equipment Storage is located in the HAZMAT/ CBRNE storage area in Headquarters Fire Stations.
- **OCCUPANTS:** EMS Staff
- **MINIMUM AREA:** 25 SF, Net. Area added to the HAZMAT/ CBRNE storage area in Headquarters Fire Stations.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. A base material, appropriate for the flooring material used, is required. Salient characteristics include easy to clean, durable (able to withstand wet conditions, dirty conditions, and spills related to the chemicals within), easily repairable, easy to maintain, and slip resistant.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Concrete masonry units (CMU). Provide epoxy paints or industrial latex on all wall surfaces. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide "clean room" type acoustical ceiling panel (ACP) or gypsum wall board (GWB) ceiling with industrial latex or epoxy paint. Salient characteristics include durable and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include easy to clean, easy to maintain and repair, and compliance to building codes. Doors, frames, and hardware shall be able to withstand constant opening and closing. Doors shall be provided with self-closing device. Non applicable in a Headquarters Fire Stations.
- **PLUMBING:** None.
- **HVAC:** The space must be fully conditioned.
- **FIRE PROTECTION:** Provide per current codes.
- **ELECTRICAL:** Provide outlets per current codes. Provide additional outlets and power as required by equipment.
- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with fluorescent energy efficient light fixtures.

## Standard Design Criteria Fire Stations

- **COMMUNICATION:**  
CCTV. None required.  
CATV/Internal Video. None required.  
PA/Audio. None required.  
Telephone. None required.  
Data. None required.  
Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** Provide wall shelving units
- **SPECIAL REQUIREMENTS:** In the Satellite Fire Stations provide a keyed lock set at the access point to the space.

## Standard Design Criteria Fire Stations

### 12. **SPACE: HAZMAT/CBRNE and Spare PPE Equipment Storage** (Headquarters Fire Stations only).

- **FUNCTIONAL DESCRIPTION:** A dedicated storage room housing only equipment classified for use with hazardous materials. Provide sufficient floor and open shelf storage areas.
- **ADJACENCIES:** Shall be accessible from the Apparatus Bay. The EMS Equipment Storage and Logistics' Office is located in the HAZMAT/ CBRNE storage area in Headquarter Fire Stations.
- **OCCUPANTS:** Logistics Officer/ EMS Staff
- **MINIMUM AREA:** One-Company Headquarters: 240 SF, Net. Two-Company (Two-Story) Headquarters: 360 SF, Net. Three-Company (Two-Story) Headquarters: 480 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. A base material, appropriate for the flooring material used, is required. Salient characteristics include easy to clean, durable (able to withstand wet conditions, dirty conditions, and spills related to the chemicals within), easily repairable, easy to maintain, and slip resistant.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** **Concrete** masonry units (CMU). Provide epoxy paints or industrial latex on all wall surfaces. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide "clean room" type acoustical ceiling panel (ACP) or gypsum wall board (GWB) ceiling with industrial latex or epoxy paint. Salient characteristics include durable and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** **Salient characteristics include easy** to clean, easy to maintain and repair, and compliance to building codes. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device and vision panel.
- **PLUMBING:** None.
- **HVAC:** The area shall be kept under constant negative pressure to evacuate gaseous emissions from stored gear to the outside or filtration equipment that is designed to filter and remove gaseous emissions from equipment shall be provided.
- **FIRE PROTECTION:** Provide per current codes.
- **ELECTRICAL:** Provide outlets per current codes.

## Standard Design Criteria Fire Stations

- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with fluorescent energy efficient light fixtures.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. None required.
  - PA/Audio. None required.
  - Telephone. None required.
  - Data. None required.
  - Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None.
- **SPECIAL REQUIREMENTS:** Provide sufficient floor and open shelf storage areas. Entrance shall be double doors.

## Standard Design Criteria Fire Stations

### 13. **SPACE: Logistics' Office** (Headquarters Fire Stations only).

- **FUNCTIONAL DESCRIPTION:** This area includes a typical office space and workstation.
- **ADJACENCIES:** Shall be accessible from the Apparatus Bay. The Logistics' Office is located in the HAZMAT/ CBRNE storage area in Headquarter Fire Stations.
- **OCCUPANTS:** Logistics Officer
- **MINIMUM AREA:** 80 SF, Net. Area added to the HAZMAT/ CBRNE storage area.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. A base material, appropriate for the flooring material used, is required. Salient characteristics include easy to clean, durable (able to withstand wet conditions, dirty conditions, and spills related to the chemicals within), easily repairable, easy to maintain, and slip resistant.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE: Concrete** masonry units (CMU). Provide epoxy paints or industrial latex on all wall surfaces. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide "clean room" type acoustical ceiling panel (ACP) or gypsum wall board (GWB) ceiling with industrial latex or epoxy paint. Salient characteristics include durable and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include easy to clean, easy to maintain and repair, and compliance to building codes. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device and vision panel.
- **PLUMBING:** None.
- **HVAC:** The area shall be kept under constant negative pressure to evacuate gaseous emissions from stored gear to the outside or filtration equipment that is designed to filter and remove gaseous emissions from equipment shall be provided.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes. Multiple electrical and data outlets to be provided to accommodate computers and other office equipment.
- **LIGHTING:** Provide per current codes. Provide task lighting at workstation. In addition to the ambient and task lighting fixtures, provide a dedicated alert light fixture that is controllable from the Watch Desk/Dispatch and tied into the firefighting alert system with a red-tinted bulb or lens.

## Standard Design Criteria Fire Stations

- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. Provide one outlet in the office area.
  - PA/Audio. Provide a speaker.
  - Telephone. Provide one line with internal two-way communication.
  - Data. Provide data drops as required by equipment.
  - Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None.
- **SPECIAL REQUIREMENTS:** None.



## Standard Design Criteria Fire Stations

### 14. **SPACE: Fire Extinguisher Inspection (Non Flight Line)**

- **FUNCTIONAL DESCRIPTION:** This room accommodates a work bench with adequate lighting to perform maintenance and service of extinguishers, safety cage, scale, recharge kit, and parts storage bins.
- **ADJACENCIES:** Shall be directly accessible from the Apparatus Bay. Based on installation requirements, shall have an outdoor agent storage area.
- **OCCUPANTS:** Fire Station Staff
- **MINIMUM AREA:** 160 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide a sealed concrete surface sloped to drain. A non-skid, low-maintenance traffic coating may also be acceptable. A base material, appropriate for the flooring material used, is required. Salient characteristics include easy to clean, durable (able to withstand wet and dirty conditions), easily repairable, easy to maintain, and slip resistant.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Concrete masonry units (CMU). Provide epoxy paints or industrial latex on all wall surfaces. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panel (ACP) or gypsum wall board (GWB) ceiling with industrial latex or epoxy paint. Salient characteristics include durable and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include easy to clean, easy to maintain and repair, and compliance to building codes. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device and vision panel.
- **PLUMBING:** Provide a hose bibb and eye wash fountain. A floor drain is required in this area that shall be self priming, or designed to prevent sewer gases from entering the occupied space by a proven and maintenance-free design.
- **HVAC:** The area shall be kept under constant negative pressure to evacuate gaseous emissions from stored gear to the outside or filtration equipment that is designed to filter and remove gaseous emissions from equipment shall be provided. Provide a compressed air system with self-retracting lines at the work bench.
- **FIRE PROTECTION:** Provide per current codes.
- **ELECTRICAL:** Provide outlets per current codes.
- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with fluorescent energy efficient light fixtures. Provide task lighting at workstation.

## Standard Design Criteria Fire Stations

- **COMMUNICATION:**  
CCTV. None required.  
CATV/Internal Video. Provide one outlet in the office area.  
PA/Audio. Provide a speaker.  
Telephone. Provide one line with internal two-way communication.  
Data. Provide quad outlet at work bench and in locations where required to accommodate equipment.  
Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None.
- **SPECIAL REQUIREMENTS:** Entrance shall be double doors. Based on installation requirements, shall have an outdoor agent storage area. The outdoor storage area is covered, enclosed with a secured screen. The outdoor storage area is covered, enclosed with a secured screen, and accommodates tank recovery, spare tanks, and spare gaseous agent re-servicing tanks at 40 SF, net per station.

## Standard Design Criteria Fire Stations

### 15. **SPACE: Fire Extinguisher Inspection (Flight Line)**

- **FUNCTIONAL DESCRIPTION:** This room accommodates a work bench with adequate lighting to perform maintenance and service of extinguishers, safety cage, scale, recharge kit, and parts storage bins.
- **ADJACENCIES:** Shall be directly accessible from the Apparatus Bay. Based on installation requirements, shall have an outdoor agent storage area.
- **OCCUPANTS:** Fire Station Staff
- **MINIMUM AREA:** 160 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide a sealed concrete surface sloped to drain. A non-skid, low-maintenance traffic coating may also be acceptable. A base material, appropriate for the flooring material used, is required. Salient characteristics include easy to clean, durable (able to withstand wet and dirty conditions), easily repairable, easy to maintain, and slip resistant.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Concrete masonry units (CMU). Provide epoxy paints or industrial latex on all wall surfaces. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panel (ACP) or gypsum wall board (GWB) ceiling with industrial latex or epoxy paint. Salient characteristics include durable and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include easy to clean, easy to maintain and repair, and compliance to building codes. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device and vision panel.
- **PLUMBING:** Provide a hose bibb and eye wash fountain. A floor drain is required in this area that shall be self priming, or designed to prevent sewer gases from entering the occupied space by a proven and maintenance-free design.
- **HVAC:** The area shall be kept under constant negative pressure to evacuate gaseous emissions from stored gear to the outside or filtration equipment that is designed to filter and remove gaseous emissions from equipment shall be provided. Provide a compressed air system with self-retracting lines at the work bench.
- **FIRE PROTECTION:** Provide per current codes.
- **ELECTRICAL:** Provide outlets per current codes.
- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with fluorescent energy efficient light fixtures. Provide task lighting at workstation.

## Standard Design Criteria Fire Stations

- **COMMUNICATION:**  
CCTV. None required.  
CATV/Internal Video. Provide one outlet in the office area.  
PA/Audio. Provide a speaker.  
Telephone. Provide one line with internal two-way communication.  
Data. Provide quad outlet at work bench and in locations where required to accommodate equipment.  
Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None.
- **SPECIAL REQUIREMENTS:** Entrance shall be double doors. Based on installation requirements, shall have an outdoor agent storage area. The outdoor storage area is covered, enclosed with a secured screen. The outdoor storage area is covered, enclosed with a secured screen, and accommodates tank recovery, spare tanks, and spare gaseous agent re-servicing tanks at 40 SF, net per station.

## Standard Design Criteria Fire Stations

### 16. SPACE: Clean-Up Room

- **FUNCTIONAL DESCRIPTION:** This area provides showers and lockers for the fire station staff to decontaminate themselves before entering the Living portion of the Fire Station. A service window shall be provided to the Protective Clothing Laundry room.
- **ADJACENCIES:** Shall be directly accessible from the Apparatus Bay. The Clean-Up Room shall be adjacent to Protective Clothing Laundry Room and a service window provided.
- **OCCUPANTS:** Fire Station Staff
- **MINIMUM AREA:** 160 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide a sealed concrete surface sloped to drain. A base material, appropriate for the flooring material used, is required. Salient characteristics include easy to clean, durable (able to withstand wet and dirty conditions), easily repairable, easy to maintain, and slip resistant.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Concrete masonry units (CMU). Provide epoxy paints or industrial latex on all wall surfaces. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide skim-coated cementitious backer board ceiling. Salient characteristics include durable and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include easy to clean, easy to maintain and repair, and compliance to building codes. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device.
- **SERVICE WINDOW/FRAME:** Salient characteristics include durability.
- **PLUMBING:** Provide private shower stalls. See Special Requirements below for distribution. A floor drain is required in this area that shall be self priming, or designed to prevent sewer gases from entering the occupied space by a proven and maintenance-free design.
- **HVAC:** Provide per current codes.
- **FIRE PROTECTION:** Provide per current codes.
- **ELECTRICAL:** Provide outlets per current codes.
- **LIGHTING:** Provide per current codes.

## Standard Design Criteria Fire Stations

- **COMMUNICATION:**  
CCTV. None required.  
CATV/Internal Video. None required.  
PA/Audio. Provide a speaker.  
Telephone. None required.  
Data. None required.  
Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** Provide 12-in deep minimum solid surface materials for seating. Provide 24-in. deep minimum resin based materials for showers.
- **SPECIAL REQUIREMENTS:** Provide sufficient floor areas for lockers. The following shall be provided:  
  
Minimum two private showers w/ changing areas and full privacy doors shall be provided for One-Company Fire Stations.  
  
Minimum two private showers w/ changing areas and full privacy doors shall be provided for Two-Company Fire Stations.  
  
Minimum three private showers w/ changing areas and full privacy doors shall be provided for Three-Company Fire Stations.

## Standard Design Criteria Fire Stations

### 17. SPACE: Storage of Structural and ARFF Agent

- **FUNCTIONAL DESCRIPTION:** This area is a single-story structure utilized for ease of loading and unloading of firefighting agents.
- **ADJACENCIES:** Shall be separate from the Fire Station building and located along the drive leading into the Apparatus Bay.
- **OCCUPANTS:** Fire Station Staff
- **MINIMUM AREA:** 160 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide a sealed concrete surface sloped to drain. A non-skid, low-maintenance traffic coating may also be acceptable. A base material, appropriate for the flooring material used, is required. Salient characteristics include easy to clean, durable (able to withstand wet and dirty conditions), easily repairable, and easy to maintain.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Concrete masonry units (CMU). Provide epoxy paints or industrial latex on all wall surfaces. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panel (ACP) or gypsum wall board (GWB) ceiling with industrial latex or epoxy paint. Salient characteristics include durable and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include easy to clean, easy to maintain and repair, and compliance to building codes. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device.
- **PLUMBING:** Provide a hose bibb and floor drain. Provide eye wash fountain.
- **HVAC:** Provide per current codes. The area shall be kept under constant negative pressure to evacuate gaseous emissions from stored gear to the outside.
- **FIRE PROTECTION:** Provide per current codes.
- **ELECTRICAL:** Provide outlets per current codes.
- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with fluorescent energy efficient light fixtures.
- **COMMUNICATION:**  
CCTV. None required.  
CATV/Internal Video. Provide one outlet in the office area.

## Standard Design Criteria Fire Stations

PA/Audio. Provide a speaker.

Telephone. Provide one line with internal two-way communication.

Data. Provide quad outlet at work bench and in locations where required to accommodate equipment.

Security. None required.

- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None.
- **SPECIAL REQUIREMENTS:** Entrance shall be double doors.



## Standard Design Criteria

### Fire Stations

#### 18. **SPACE: Fire Chief's Office Suite** (Headquarters Fire Stations only).

- **FUNCTIONAL DESCRIPTION:** The area includes a typical office space and workstation. An adjacent private bedroom and private toilet/shower should be directly accessible from the Fire Chief's Office.
- **ADJACENCIES:** This area is in the Administrative Office area of the Fire Station. Shall be adjacent to the Deputy Chief's Office and directly off the Lobby.
- **OCCUPANTS:** Fire Chief.
- **MINIMUM AREA:**  
Fire Chief's Office: 200 SF, Net.  
Fire Chief's Dorm Room: 85 SF, Net.  
Fire Chief's Toilet/Shower: 60 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide durable commercial carpeting in office and sleeping area. Provide ceramic tile and ceramic tile base in toilet/shower. A base material, appropriate for the flooring material used, is required. Base shall be sealed to the flooring in the toilet/shower. Salient characteristics include durable and easy to clean, repairable, easy to maintain, and slip resistant.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. In toilet/shower provide moisture and mildew resistant gypsum wall board. Provide a low-maintenance finish such as egg-shell latex paint. On all walls, a minimum 48" tall wainscot is required that is impervious to water and be able to withstand daily sanitizing. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. Consider providing vinyl wall coverings in the toilet/showers.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP) in office and sleeping areas. Provide moisture resistant gypsum board ceiling in the toilet. Consider semi-gloss industrial paint in the toilet. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be a minimum of half-height glass. Doors shall be provided with self-closing device.
- **PLUMBING:** Provide water closet, shower, and lavatory. Consider providing floor drain.
- **HVAC:** Provide per current codes. Consider providing independent thermostat.

## Standard Design Criteria Fire Stations

- **FIRE PROTECTION:** Provide per current codes. Provide smoke and CO detectors.
- **ELECTRICAL:** Provide outlets per current codes. Multiple electrical and data outlets to be provided to accommodate computers and other office equipment.
- **LIGHTING:** Provide per current codes. Provide residential-style fixtures and task lighting at desk. In addition to the ambient and task lighting fixtures, provide a dedicated alert light fixture that is controllable from the Watch Desk/Dispatch and tied into the firefighting alert system with a red-tinted bulb or lens.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. Provide one outlet in the office area and one outlet in the bedroom area.
  - PA/Audio. Provide speaker.
  - Telephone. Provide one line with internal two-way communication.
  - Data. Provide data drops as required by equipment.
  - Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** Provide 24-in deep minimum solid surface materials for countertop. Provide 24-in deep minimum resin based materials for shower.
- **SPECIAL REQUIREMENTS:** None.

## Standard Design Criteria

### Fire Stations

#### 19. **SPACE: Fire Chief's Conference Room** (Headquarters Fire Stations only).

- **FUNCTIONAL DESCRIPTION:** The area includes a space for a small conference table for 8 to 10 people.
- **ADJACENCIES:** Directly accessible from the corridor in the Administrative Office area.
- **OCCUPANTS:** Fire Station Staff.
- **MINIMUM AREA:** 240 SF, Net.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide durable commercial carpeting. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP) or gypsum wall board (GWB) ceiling. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device and vision panel.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes. Consider providing independent thermostat.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes. Multiple electrical and data outlets to be provided to accommodate computers and other office equipment.
- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with fluorescent energy efficient light fixtures. In addition to the ambient lighting fixtures, provide a dedicated alert light fixture that is controllable from the Watch Desk/Dispatch and tied into the firefighting alert system with a red-tinted bulb or lens.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. Provide one outlet.
  - PA/Audio. Provide speaker.
  - Telephone. Provide one line with internal two-way communication.
  - Data. Provide data drops as required by equipment.

**Standard Design Criteria  
Fire Stations**

Visual. Provide outlets and data drops for an overhead projector and electric overhead projector screen.

Security. None required.

- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None
- **SPECIAL REQUIREMENTS:** Provide retractable overhead screen and overhead projector mount.

## Standard Design Criteria Fire Stations

### 20. SPACE: Deputy Chief's Office (Headquarters Fire Stations only).

- **FUNCTIONAL DESCRIPTION:** The room includes a typical office space and workstation.
- **ADJACENCIES:** This area is in the Administrative Office area of the Fire Station. Shall be adjacent to the Fire Chief's Suite and directly off the Lobby.
- **OCCUPANTS:** Fire Chief.
- **MINIMUM AREA:** 120 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide durable commercial carpeting in office and sleeping areas. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP) or gypsum wall board (GWB) ceiling. Consider egg-shell latex paint in office. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be a minimum of half-height glass. Doors shall be provided with self-closing device.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes. Consider providing independent thermostat.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes. Multiple electrical and data outlets to be provided to accommodate computer and other office equipment.
- **LIGHTING:** Provide per current codes. Provide residential-style fixtures and task lighting at desk. In addition to the ambient and task lighting fixtures, provide a dedicated alert light fixture that is controllable from the Watch Desk/Dispatch and tied into the firefighting alert system with a red-tinted bulb or lens.
- **COMMUNICATION:**  
CCTV. None required.

## Standard Design Criteria

### Fire Stations

CATV/Internal Video. Provide one outlet in the office area and one outlet in the bedroom area.

PA/Audio. Provide speaker.

Telephone. Provide one line with internal two-way communication.

Data. Provide data drops as required by equipment.

Security. None required.

- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None
- **SPECIAL REQUIREMENTS:** None.

## Standard Design Criteria

### Fire Stations

#### 21. **SPACE: Station Officer's Office/Watch Desk** (Satellite Fire Stations only).

- **FUNCTIONAL DESCRIPTION:** This room provides space for the station officer and/or company officers to perform their administrative functions. The Station Officer's office may serve to control public access to the station. If a Watch Desk function is required, it is typically included in the Station Officer's Office. The Watch Desk receives emergency calls from the Dispatch and contains the security monitors for the station. It is usually occupied 24 hours a day/7 days a week. The room includes a typical office space and workstations for two people.
- **ADJACENCIES:** This area is in the Administrative Office area of the Fire Station. Shall be located directly off the Lobby.
- **OCCUPANTS:** Station Officer.
- **MINIMUM AREA:** 230 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. Consider providing durable commercial carpeting. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP). Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be a minimum of half-height glass. Doors shall be provided with self-closing device.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes. Consider providing independent thermostat.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide electrical and data outlets per current codes and as needed to support the extensive equipment required. Provide two additional quad outlets at the control center console. Provide a switch controlling operation of Apparatus Bay doors.

## Standard Design Criteria

### Fire Stations

- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with fluorescent energy efficient light fixtures. Provide task lighting at control desk.
- **COMMUNICATION:**
  - CCTV. If CCTV is provided monitors for the facility cameras will be located here. Provide outlets required to support equipment.
  - CATV/Internal Video. Provide outlets required to support required equipment.
  - PA/Audio. Provide simultaneous light and audible control for the entire fire station.
  - Telephone. Provide regular and secure multi-telephone line required to support switch board operation, telephone, and fax.
  - Data. Provide regular and secure data outlets to support required equipment.
  - Security. Provide vision panel to the Apparatus Bay. Provide pin pad/cipher electric lock with remote push button release and manual key override.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 45.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None
- **SPECIAL REQUIREMENTS:**
  - Firefighter Alert System:** Provide light and audible control for the following elements when the firefighter alert system is activated: Dorm Room lights (the dedicated alert light), corridor lights from Dorm Rooms to Apparatus Bay, and the Apparatus Bay lights.

Provide a 36 in. (920 mm) free access area around the entire control console. Provide space for Emergency Information Systems computer. Provide tinted windows.



## Standard Design Criteria

### Fire Stations

#### 22. **SPACE: Assistant Chief/Shift Supervisor's Suite** (Headquarters Fire Stations only).

- **FUNCTIONAL DESCRIPTION:** The area includes a typical office space and workstation. An adjacent private bedroom and private toilet /shower shall be directly accessible from the Assistant Chief's Office.
- **ADJACENCIES:** This area is in the Administrative Office area of the Fire Station. Shall be adjacent to the Station's Captain Suite and directly accessible from the corridor in the Administrative Office area. The private toilet/shower shall be accessible from the Station's Captain Dorm room, also.
- **OCCUPANTS:** Assistant Chief/Shift Supervisor.
- **MINIMUM AREA:**  
Assistant Chief/Shift Supervisor's Suite: 120 SF, Net.  
Assistant Chief/Shift Supervisor's Dorm Room: 85 SF, Net.  
Assistant Chief/Shift Supervisor's Toilet/Shower: 60 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** In the Office and dorm areas, provide low maintenance sheet or tile vinyl flooring material. Consider providing commercial carpeting. Provide ceramic tile and ceramic tile base in toilet/shower. A base material, appropriate for the flooring material used, is required. Base shall be sealed to the flooring in the toilet/shower. Salient characteristics include durable and easy to clean, repairable, easy to maintain, and slip resistant.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Concrete masonry units (CMU) at shared walls with Apparatus Equipment & Maintenance areas. GWB is an allowable material, including a furred application attached to the CMU walls. In the office and dorm room, provide a low-maintenance finish such as egg-shell latex paint. In toilet/shower provide moisture and mildew resistant gypsum wall board. Provide a low-maintenance finish such as egg-shell latex paint. On all walls, a minimum 48" tall wainscot is required that is impervious to water and be able to withstand daily sanitizing. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. Consider providing vinyl wall coverings in the toilet/showers.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP) in office and dorm areas. Provide moisture resistant gypsum board ceiling in the toilet. Consider semi-gloss industrial paint in the toilet. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be a minimum of half-height glass. Doors shall be provided with self-closing device.

## Standard Design Criteria Fire Stations

- **PLUMBING:** Provide water closet, shower, and lavatory. Consider providing floor drain.
- **HVAC:** Provide per current codes. Consider providing independent thermostat.
- **FIRE PROTECTION:** Provide per current codes. Provide smoke and CO detectors.
- **ELECTRICAL:** Provide outlets per current codes. Multiple electrical and data outlets to be provided to accommodate computers and other office equipment.
- **LIGHTING:** Provide per current codes. Provide residential-style fixtures and task lighting at desk. In addition to the ambient and task lighting fixtures, provide a dedicated alert light fixture that is controllable from the Watch Desk/Dispatch and tied into the firefighting alert system with a red-tinted bulb or lens.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. Provide one outlet in the office area and one outlet in the bedroom area.
  - PA/Audio. Provide speaker.
  - Telephone. Provide one line with internal two-way communication.
  - Data. Provide data drops as required by equipment.
  - Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** Provide 24-in deep minimum solid surface materials for countertops. Provide 24-in deep minimum resin based materials for shower.
- **SPECIAL REQUIREMENTS:** The Assistant Chief/Shift Supervisor's Suite will likely have CMU walls and more durable finishes than typical offices. The Assistant Chief/Shift Supervisor's Suite walls shared with the Administrative & Training areas are allowed to be of materials other than CMU.

## Standard Design Criteria Fire Stations

### 23. SPACE: General Administration Storage

- **FUNCTIONAL DESCRIPTION:** This area is general storage for office supplies and other supplies.
- **ADJACENCIES:** This area is in the Administrative Office area of the Fire Station. Shall be directly accessible from the corridor and/or Lobby in the Administrative Office area.
- **OCCUPANTS:** Fire Station Staff.
- **MINIMUM AREA:** 80 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP). Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes.
- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with fluorescent energy efficient light fixtures.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. None required.
  - PA/Audio. None required.
  - Telephone. None required.
  - Data. None required.
  - Security. None required.

**Standard Design Criteria  
Fire Stations**

- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 40.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None
- **SPECIAL REQUIREMENTS:** A minimum of 4 adjustable shelves with heavy duty standards and brackets will be provided. Provide shelves on as many walls of the storage rooms as possible while maintaining adequate circulation space. Shelving shall be able to support 100 pounds per lineal foot.

## Standard Design Criteria Fire Stations

### 24. SPACE: Lobby

- **FUNCTIONAL DESCRIPTION:** This area serves as the entrance to the facility and a gathering/waiting space for the visiting public. The Lobby should be recognizable from the outside as a well-lit, inviting space.
- **ADJACENCIES:** This area is in the Administrative Office area of the Fire Station and is the main entrance into the Fire Station.
- **OCCUPANTS:** Fire Station Visitors.
- **MINIMUM AREA:** 100 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required. Consider stone or quarry tile with stone or tile base.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. Consider providing vinyl wall coverings.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide decorative acoustical ceiling panels (ACP). Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Provide a set of storefront double 3 foot by 7 foot doors, fitted with a locking mechanism and flush panic hardware at the entry. To ensure maximum visibility, doors shall be fully glazed. Doors shall be provided with self-closing device.
- **PLUMBING:** Provide water for an ABA compliant electric water cooler.
- **HVAC:** Provide per current codes.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes. Consider outlets for display cases.
- **LIGHTING:** Provide per current codes. Consider decorative lighting fixtures and task lighting.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. None required.
  - PA/Audio. Provide speaker.

**Standard Design Criteria  
Fire Stations**

Telephone. Consider providing one line for local and toll-free calls or a pay phone.

Data. None required.

Security. None required.

- **ACOUSTICS:** None.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None
- **SPECIAL REQUIREMENTS:**  
Provide airlock at main entrance when necessary.

Consider a recessed, built-in mat at entry.

## Standard Design Criteria Fire Stations

### 25. SPACE: Public Toilet

- **FUNCTIONAL DESCRIPTION:** This area shall be an ABA compliant toilet area for visitors.
- **ADJACENCIES:** This area is in the Administrative Office area of the Fire Station. Public toilets shall be located directly adjacent to the Lobby. Staff toilets shall be accessible from the corridors, and should be spread out around the facility.
- **OCCUPANTS:** Visitor.
- **MINIMUM AREA:** 48 SF, Net.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Floors shall be able to keep water from getting under the flooring material. Salient characteristics include durable and easy to clean, repairable, easy to maintain, and slip resistant. A base material, appropriate for the flooring material used, is required. Base shall be sealed to the flooring.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Providing moisture and mildew resistant gypsum wall board. Provide a low-maintenance finish such as egg-shell latex paint. On all walls, a minimum 48" tall wainscot is required that is impervious to water and be able to withstand daily sanitizing. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE.** Provide moisture resistant gypsum board ceiling. Consider semi-gloss industrial paint. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Door shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device.
- **PLUMBING:** 1 ABA compliance water closet, and 1 ABA compliant lavatory. A floor drain is required in this area that shall be self priming, or designed to prevent sewer gases from entering the occupied space by a proven and maintenance-free design.
- **HVAC:** Provide per current codes. Local exhaust vent above toilet.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes.
- **LIGHTING:** Provide per current codes.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. None required.
  - PA/Audio. None required.

## **Standard Design Criteria Fire Stations**

Telephone. None required.

Data. None required.

Security. None required.

- **ACOUSTICS:** None.
- **CASEWORKS/BUILT-IN EQUIPMENT:** Provide 24-in deep minimum solid surface materials for countertop.
- **SPECIAL REQUIREMENTS:** None.



## Standard Design Criteria

### Fire Stations

#### 26. **SPACE: Dispatch's Suite** (Headquarters Fire Stations only).

- **FUNCTIONAL DESCRIPTION:** The main access control point with direct visual contact with the entry, lobby, and public toilet. Responsible for receiving and dispatching fire related emergency calls. This area contains the security monitors for the station and is occupied 24 hours a day, 7 days a week. Provide a dedicated toilet and kitchenette, and dedicated IT room directly adjacent to and accessible from the Dispatch Room for staff use. Provide tinted windows. If possible, operators should be able to see exterior conditions.
- **ADJACENCIES:** This area is in the Administrative Office area of the Fire Station. This area is adjacent to lobby area. Shall have direct visual control service window to and direct access to the Lobby.
- **OCCUPANTS:** Dispatch staff.
- **MINIMUM AREA:**  
Dispatch's Suite: 256 SF, Net.  
Dispatch's Toilet: 48 SF, Net.  
Dispatch's Kitchenette: 20 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** In the Dispatch and Kitchenette, provide low maintenance sheet or tile vinyl flooring material. Consider providing commercial carpeting. In the toilet, floors shall be able to keep water from getting under the flooring material. A base material, appropriate for the flooring material used, is required. Base shall be sealed to the flooring in the toilet. Salient characteristics include durable and easy to clean, repairable, easy to maintain, and slip resistant.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** In the Dispatch and Kitchenette, provide a low-maintenance finish such as egg-shell latex paint. In the toilet, provide moisture and mildew resistant gypsum wall board. Provide a low-maintenance finish such as egg-shell latex paint. On all walls, a minimum 48" tall wainscot is required that is impervious to water and be able to withstand daily sanitizing. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. Consider providing vinyl wall coverings in the toilet/shower.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** In the Dispatch and Kitchenette, provide acoustical ceiling panels (ACP). In the toilet, provide moisture resistant gypsum board ceiling. Consider semi-gloss industrial paint. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Door shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device.

## Standard Design Criteria

### Fire Stations

- **SERVICE WINDOW/FRAME:** Provide window with pass-through transaction drawer. Salient characteristics include durability.
- **PLUMBING:** Provide an ABA-accessible toilet with a lavatory and water closet. Provide a kitchenette with a kitchen sink and disposal.
- **HVAC:** Provide per current codes. Provide independent environmental control equipment.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes and as needed to support all equipment, including charging equipment for handhelds. Provide a switch controlling open only operation of Apparatus Bay doors.
- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with fluorescent energy efficient light fixtures and emergency battery back-up. Consider providing task lighting at control desk.
- **COMMUNICATION:**  
CCTV. If CCTV is provided, monitors for the facility cameras will be located here. Provide outlets required to support equipment.  
CATV/Internal Video. Provide outlets required to support equipment.  
PA/Audio. Provide a speaker and a microphone.  
Telephone. Provide regular and secure multi-telephone line required to support switchboard operation, telephone, and fax.  
Data. Provide regular and secure data outlets to support required equipment.  
Security. Provide pin pad/cipher electric lock with remote push button release and manual key override.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 49.
- **CASEWORKS/BUILT-IN EQUIPMENT:** At kitchenette, provide wall and base cabinets with 24-in deep solid surface counter. Provide 24-in deep minimum solid surface materials for countertop.
- **SPECIAL REQUIREMENTS:**  
 Comply with the requirements for "Communication Centers" in NFPA 1221.

Note that some equipment requires free access area around the entire control console. Design this space appropriate to the equipment being provided. Note any special requirements for the E911 system, if appropriate. If required for selected equipment, provide a conduit to the roof for a roof mounted antennae.

**Firefighter Alert System:** Provide light and audible control for the following elements when the firefighter alert system is activated: Dorm Room lights (the dedicated alert light), corridor lights from Dorm Rooms to Apparatus Bay, and the Apparatus Bay lights.

The generator must provide back-up power for all Dispatch Room systems. In addition, provide uninterrupted power supply (UPS) for the dispatch equipment.

## Standard Design Criteria Fire Stations

### 27. SPACE: UPS Room.

- **FUNCTIONAL DISCRIPTION:** This room houses the equipment racks for the Dispatch or Station Officer's Office/Watch Desk area's computer networks, telephone, communication feeds, and an Uninterrupted Power Source (UPS).
- **ADJACENCIES:** This area is in the Administrative Office area of the Fire Station. UPS room shall be provided adjacent to and accessible from the Dispatch or Station Officer's Office/Watch Desk area.
- **OCCUPANTS:** Dispatch staff/Station Officer.
- **MINIMUM AREA:** 60 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. Salient characteristics include easy to clean, maintain, and repair. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide gypsum wall board (GWB) ceiling. Consider egg-shell latex paint. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Door shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device.
- **SERVICE WINDOW/FRAME:** Provide window with pass-through transaction drawer. Salient characteristics include durability.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes and as needed to support the extensive equipment required. Provide two additional quad outlets. Provide a transient voltage surge suppression panel board.
- **LIGHTING:** Provide per current codes.
- **COMMUNICATION:**  
CCTV. None required.  
CATV/Internal Video. None required.

## Standard Design Criteria Fire Stations

PA/Audio. None required.

Telephone. Provide telephone line as required to support equipment.

Data. Provide data lines as required to support equipment.

Security. Provide a cipher lock at the door.

- **ACOUSTICS:** None.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None.
- **SPECIAL REQUIREMENTS:** Comply with the requirements for USAISEC Technical Guide for Installation Information Infrastructure Architecture (I3A).

## Standard Design Criteria

### Fire Stations

#### 28. SPACE: Telecommunications Room

- **FUNCTIONAL DESCRIPTION:** This room shall be used for the termination of all data and communication utilities in the facility. The equipment racks for the facility's computer networks, telephone, communication feeds, and Uninterrupted Power Source (UPS) are housed in this room.
- **ADJACENCIES:** This area is in the Administrative Office area of the Fire Station. Shall be directly accessible from the corridor in the Administrative Office area and preferably centrally located in the facility.
- **OCCUPANTS:** Fire Station Staff.
- **MINIMUM AREA:** 180 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide gypsum wall board (GWB) ceiling. Consider egg-shell latex paint. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Door shall open 180 degrees into the corridor. Door shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes and as needed to support the extensive equipment required. Provide two additional quad outlets. Provide a transient voltage surge suppression panel board.
- **LIGHTING:** Provide per current codes.
- **COMMUNICATION:**  
CCTV. None required.  
CATV/Internal Video. None required.

## Standard Design Criteria

### Fire Stations

PA/Audio. None required.

Telephone. Provide telephone line as required to support equipment.

Data. Provide data lines as required to support equipment.

Security. Provide a cipher lock at the door.

- **ACOUSTICS:** None.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None.
- **SPECIAL REQUIREMENTS:** Comply with the requirements for USAISEC Technical Guide for Installation Information Infrastructure Architecture (I3A).

## Standard Design Criteria Fire Stations

### 29. **SPACE: Assistant Chief of Fire Prevention's Office** (Headquarters Fire Stations only).

- **FUNCTIONAL DESCRIPTION:** The room includes a typical office space and workstation.
- **ADJACENCIES:** This area is in the Administrative Office area of the Fire Station. Shall be adjacent to and directly off the Fire Inspectors' Office.
- **OCCUPANTS:** Assistant Chief of Fire Prevention.
- **MINIMUM AREA:** 120 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. Consider providing durable commercial carpeting. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP). Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be a minimum of half-height glass. Doors shall be provided with self-closing device.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes. Consider providing independent thermostat.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes. Multiple electrical and data outlets to be provided to accommodate computer and other office equipment.
- **LIGHTING:** Provide per current codes. Provide residential-style fixtures and task lighting at desk.
- **COMMUNICATION:**  
CCTV. None required.  
CATV/Internal Video. Provide one outlet.

## Standard Design Criteria

### Fire Stations

PA/Audio. Provide speaker.

Telephone. Provide one line with internal two-way communication.

Data. Provide data outlets as required by equipment.

Security. None required.

- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 39.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None
- **SPECIAL REQUIREMENTS:** None.



## Standard Design Criteria

### Fire Stations

#### 30. SPACE: Inspector(s)' Office (Headquarters Fire Stations only).

- **FUNCTIONAL DESCRIPTION:** The room includes a typical office space and workstation.
- **ADJACENCIES:** This area is in the Administrative Office area of the Fire Station. Shall be adjacent to Fire Inspectors' Office. Shall be directly accessible from the corridor in the Administrative Office area.
- **OCCUPANTS:** Fire Inspector(s)' Staff.
- **MINIMUM AREA:**  
One Company Headquarters: 144 SF, Net. One Inspector  
Two Company Headquarters: 288 SF, Net. Two Inspectors  
Three Company Headquarters: 432 SF, Net. Three Inspectors
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. Consider providing durable commercial carpeting. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP). Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes. Multiple electrical and data outlets to be provided to accommodate computer and other office equipment.
- **LIGHTING:** Provide per current codes. Provide task lighting at desk.
- **COMMUNICATION:**  
CCTV. None required.

## Standard Design Criteria

### Fire Stations

CATV/Internal Video. Provide one outlet.

PA/Audio. Provide speaker.

Telephone. Provide one line with internal two-way communication per Fire Inspector's workstation.

Data. Provide data outlets as required by equipment.

Security. None required.

- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 39.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None
- **SPECIAL REQUIREMENTS:** None.

## Standard Design Criteria Fire Stations

### 31. **SPACE: Training Officer's Office** (Headquarters Fire Stations only).

- **FUNCTIONAL DESCRIPTION:** The room includes a typical office space and workstation. Observation windows shall be provided to the Computer Training/Testing Room and Department Training Room to monitor and control access.
- **ADJACENCIES:** This area is in the Administrative Office area of the Fire Station. Shall be directly accessible from the corridor in the Administrative Office area. Shall be adjacent to the Department Training Room and Computer Training/Testing Room with an observation window to each room.
- **OCCUPANTS:** Training Officer.
- **MINIMUM AREA:** 100 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. Consider providing durable commercial carpeting. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP). Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be a minimum of half-height glass. Doors shall be provided with self-closing device.
- **OBSERVATION WINDOW/FRAME:** Salient characteristics include durability. Glass shall be tinted for privacy.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes. Consider providing independent thermostat.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes. Multiple electrical and data outlets to be provided to accommodate computer and other office equipment.

## Standard Design Criteria Fire Stations

- **LIGHTING:** Provide per current codes. Provide residential-style fixtures and task lighting at desk.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. Provide one outlet.
  - PA/Audio. Provide speaker.
  - Telephone. Provide one line with internal two-way communication.
  - Data. Provide data outlets as required by equipment.
  - Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 39.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None
- **SPECIAL REQUIREMENTS:** None.

## Standard Design Criteria

### Fire Stations

#### 32. **SPACE: Department Training Room** (Headquarters Fire Stations only).

- **FUNCTIONAL DESCRIPTION:** This area is utilized for continuing education and training. It is sized to accommodate the entire on-duty population of the Fire Station.
- **ADJACENCIES:** This area is in the Administrative Office area of the Fire Station. Shall be directly accessible from the corridor in the Administrative Office area. Shall be adjacent to and have direct access to Training Room Storage room. Shall be adjacent to the Training Officer's Office and Computer Training/Testing Room with an observation window from the Training Officer's Office.
- **OCCUPANTS:** Fire Station Staff.
- **MINIMUM AREA:**  
One Company Headquarters: 420 SF, Net.  
Two Company Headquarters: 700 SF, Net.  
Three Company Headquarters: 980 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. Consider providing durable commercial carpeting. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP). Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be a minimum of half-height glass. Doors shall be provided with self-closing device.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes. Provide independent thermostat.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes. Providing direct power to each work table.
- **LIGHTING:** Provide per current codes.

## Standard Design Criteria Fire Stations

- **COMMUNICATION:**  
CCTV. None required.  
CATV/Internal Video. Provide one outlet.  
PA/Audio. Provide speaker.  
Telephone. Provide one line with internal two-way communication.  
Data. Provide data outlets to every workstation. Provide outlets and data drops for an overhead projector and electric overhead projector screen.  
Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 45.
- **CASEWORKS/BUILT-IN EQUIPMENT:** Provide overhead retractable screen and overhead projector mount.
- **SPECIAL REQUIREMENTS:** Provide audiovisual capabilities with phone and Internet connections for each training station. Provide retractable overhead screen and overhead projector mount.

## Standard Design Criteria

### Fire Stations

#### 33. **SPACE: Training Room Storage** (Headquarters Fire Stations only).

- **FUNCTIONAL DESCRIPTION:** This area is storage for audiovisual equipment, media, and additional equipment and furnishings.
- **ADJACENCIES:** This area is in the Administrative Office area of the Fire Station. Shall be directly accessible from the Department Training Room.
- **OCCUPANTS:** Training Officer.
- **MINIMUM AREA:** 80 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP). Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes.
- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with fluorescent energy efficient light fixtures.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. None required.
  - PA/Audio. None required.
  - Telephone. None required.
  - Data. None required.
  - Security. None required.

**Standard Design Criteria  
Fire Stations**

- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 40.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None
- **SPECIAL REQUIREMENTS:** A minimum of 4 adjustable shelves with heavy duty standards and brackets will be provided. Provide shelves on as many walls of the storage rooms as possible while maintaining adequate circulation space. Shelving shall be able to support 100 pounds per lineal foot.



## Standard Design Criteria Fire Stations

### 34. SPACE: Computer Training/ Testing Room

- **FUNCTIONAL DESCRIPTION:** This area is utilized for Computer Training and Testing consisting of space for carrels for study and testing.
- **ADJACENCIES:** This area is in the Administrative Office area of the Fire Station. Shall be directly accessible from the corridor in the Administrative Office area. Shall be adjacent to the Training Officer's with an observation window from the Training Officer's Office.
- **OCCUPANTS:** Fire Station Staff.
- **MINIMUM AREA:** 190 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. Consider providing durable commercial carpeting. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP). Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be a minimum of half-height glass. Doors shall be provided with self-closing device.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes. Consider providing independent thermostat.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes. Provide direct power to each computer/study carol and printer.
- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with fluorescent energy efficient light fixtures.
- **COMMUNICATION:**  
CCTV. Provide video camera with monitor located in Training Officer's Office.

## Standard Design Criteria Fire Stations

CATV/Internal Video. None required.

PA/Audio. Provide speaker.

Telephone. None required.

Data. Provide data outlets to all workstations and equipment.

Security. None required.

- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 49.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None.
- **SPECIAL REQUIREMENTS:** None.

## Standard Design Criteria

### Fire Stations

#### 35. SPACE: **EMS Office** (Headquarters Fire Stations only).

- **FUNCTIONAL DESCRIPTION:** The room includes a typical office space and workstation
- **ADJACENCIES:** This area is in the Administrative Office area of the Fire Station. Shall be directly accessible from the corridor in the Administrative Office area.
- **OCCUPANTS:** EMS Staff.
- **MINIMUM AREA:** 80 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. Consider providing durable commercial carpeting. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP). Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be a minimum of half-height glass. Doors shall be provided with self-closing device.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes. Consider providing independent thermostat.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes. Multiple electrical and data outlets to be provided to accommodate computer and other office equipment.
- **LIGHTING:** Provide per current codes. Provide residential-style fixtures and task lighting at desk.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. Provide one outlet.
  - PA/Audio. Provide speaker.

## Standard Design Criteria

### Fire Stations

Telephone. Provide one line with internal two-way communication.

Data. Provide data outlets as required by equipment.

Security. None required.

- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 39.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None
- **SPECIAL REQUIREMENTS:** None.

## Standard Design Criteria

### Fire Stations

#### 36. SPACE: HAZMAT/Safety Office (Headquarters Fire Stations only).

- **FUNCTIONAL DESCRIPTION:** The room includes a typical office space and workstation
- **ADJACENCIES:** This area is in the Administrative Office area of the Fire Station. Shall be directly accessible from the corridor in the Administrative Office area.
- **OCCUPANTS:** HAZMAT/Safety Staff.
- **MINIMUM AREA:** 120 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. Consider providing durable commercial carpeting. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP). Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be a minimum of half-height glass. Doors shall be provided with self-closing device.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes. Consider providing independent thermostat.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes. Multiple electrical and data outlets to be provided to accommodate computer and other office equipment.
- **LIGHTING:** Provide per current codes. Provide residential-style fixtures and task lighting at desk.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. Provide one outlet.
  - PA/Audio. Provide speaker.

**Standard Design Criteria  
Fire Stations**

Telephone. Provide one line with internal two-way communication.

Data. Provide data outlets as required by equipment.

Security. None required.

- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 39.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None
- **SPECIAL REQUIREMENTS:** None.

## Standard Design Criteria

### Fire Stations

#### 37. SPACE: Day/Training Room (Includes Kitchen)

- **FUNCTIONAL DESCRIPTION:** The room shall be configured and furnished like a large residential kitchen/dining/living room. The dining area shall be flexible to accommodate various functions such as informal meetings and group training for the number of companies on duty. Provide means of natural light in the Dining area. Shall have comfortable seating for TV watching, reading, and relaxation in the living room area. Kitchen shall be sized to provide ample room for meal preparation for the entire facility's overnight population. All kitchen appliances shall be light commercial grade. Separate dry and cold food storage shall be provided for each shift.
- **ADJACENCIES:** This area is in the Living Area of the Fire Station. Shall be directly accessible from the corridor in the Living Area.
- **OCCUPANTS:** Fire Station Staff.
- **MINIMUM AREA:**  
One Company: 648 SF, Net.  
Two Company: 1,296 SF, Net.  
Three Company: 1,944 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. In the Living Room area, consider providing durable commercial carpeting. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint in the Dining and Living Room areas and semi-gloss industrial latex based paint in the Kitchen area. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP) or gypsum wall board (GWB) with egg-shell paint. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Provide a set of exterior 3 foot by 7 foot doors, fitted with a locking mechanism and flush panic hardware at the exit. Doors shall be provided with self-closing device.
- **PLUMBING:** Provide two-basin, deep kitchen sink. Provide connections for the dishwashers, coffee and ice makers. A floor drain is required in this area that shall be self priming, or designed to prevent sewer gases from entering the occupied space by a proven and maintenance-free design.

## Standard Design Criteria

### Fire Stations

- **HVAC:** Provide per current codes. Provide exhaust hood over kitchen stoves appropriate to the grade of equipment provided.
- **FIRE PROTECTION:** Provide per current codes. Refer to NFPA 96 to confirm fire protection requirements for the grade of kitchen equipment provided. Provide carbon monoxide and smoke detectors.
- **ELECTRICAL:** Provide outlets per current codes and to accommodate all kitchen equipment. Provide dedicated circuits as necessary to minimize power interruptions.
- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with incandescent energy efficient light fixtures. Consider residential-style lighting fixtures. Consider providing dimmers for all light fixtures.
- **COMMUNICATION:**  
CCTV. None required.  
CATV/Internal Video. Provide at least one outlet in the Day Room area.  
PA/Audio. Provide speaker.  
Telephone. Provide one line with internal two-way communication.  
Data. Provide at least one outlet in the dining/training area. Consider providing outlets in the living room area. In Satellite stations, provide outlets and data drops for an overhead projector and electric overhead projector screen.  
Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 45.
- **CASEWORKS/BUILT-IN EQUIPMENT:** Provide base and wall cabinets with 24-in. deep solid surface work counter. Provide a minimum of two separate dry storage closets or pantries (one for each of two shifts).
- **SPECIAL REQUIREMENTS:**  
 Kitchen area: Provide space for a large-capacity dishwasher, stove/range, exhaust hood, and free-standing ice maker. Provide space for a minimum of two separate refrigerators with freezers (one for each of two shifts), microwave oven, commercial-grade coffee maker, and toaster oven. All equipment shall be commercial grade.  
  
 Dining/Training area: Provide space for dining table with chairs. In the Satellite stations, provide retractable overhead screen and overhead projector mount.  
  
 Living Room area: Provide space for recliner armchairs, side tables, entertainment center, large-screen TV, VCR, and DVD player. Consider providing space for bookshelves and coffee table(s).



## Standard Design Criteria

### Fire Stations

#### 38. SPACE: Dorm Rooms

- **FUNCTIONAL DESCRIPTION:** The rooms are the private quarters of the firefighters and are used for sleeping during 24-hour shifts. The room is shared between two firefighters of different crews/shifts so that the room is never occupied simultaneously. Shall provide space for individual wardrobes for each firefighter. Shall provide space for a two-bed arrangement, giving each firefighter an individual bed and nightstand. The Dorm Rooms should be a comfortable, inviting space that promotes relaxation. Acoustical privacy between rooms is important. Provide means of natural light in every room.
- **ADJACENCIES:** This area is in the Living Area of the Fire Station. Shall be directly accessible from the private corridor in the Living Area.
- **OCCUPANTS:** Fire Station Staff.
- **MINIMUM AREA:** One Dorm Room: 140 SF, Net.  
One Company- 5 Dorm Rooms: 700 SF, Net.  
Two Company- 10 Dorm Rooms: 1,400 SF, Net.  
Three Company- 15 Dorm Rooms: 2,100 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. Consider providing durable commercial carpeting. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide gypsum wall board (GWB) with egg-shell latex paint. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes. Providing independent thermostat for each Dorm Room.
- **FIRE PROTECTION:** Provide per current codes. Provide carbon monoxide and smoke detectors.

## Standard Design Criteria Fire Stations

- **ELECTRICAL:** Provide outlets per current codes.
- **LIGHTING:** Provide per current codes. In addition to the ambient and task lighting fixtures, provide a dedicated alert light fixture that is controllable from the Watch Desk/Dispatch and tied into the firefighting alert system with a red-tinted bulb or lens.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. Provide one outlet.
  - PA/Audio. Provide speaker.
  - Telephone. Provide one line with internal two-way communication.
  - Data. Provide a data outlet.
  - Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None
- **SPECIAL REQUIREMENTS:** Provide space for extra-long twin bed, night table, two wardrobes, desk and desk chair, desk light, and alarm clock.

## Standard Design Criteria

### Fire Stations

#### 39. SPACE: Men Bathroom/Showers/Changing

- **FUNCTIONAL DESCRIPTION:** This area shall contain private water closets, lavatory and shower stalls with private changing areas for firefighters.
- 
- **ADJACENCIES:** This area is in the Living Area of the Fire Station. Shall be directly accessible from the corridor in the Living Area.
- **OCCUPANTS:** Fire Station Staff.
- **MINIMUM AREA:**  
One Company: 250 SF, Net.  
Two Company: 325 SF, Net.  
Three Company: 350 SF, Net.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide slip resistant ceramic tile. Floors shall be able to withstand the warm humid environment and shall be able to keep water from getting under the flooring material. Salient characteristics include durable and easy to clean, repairable, easy to maintain, and slip resistant. A base material, appropriate for the flooring material used, is required. Base shall be sealed to the flooring.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide moisture and mildew resistant gypsum wall board. Provide a full-height hard tile finish on all walls that is impervious to water and shall be able to withstand daily sanitizing. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE.** Provide skim-coated cementitious backer board ceiling. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Doors shall be provided with self-closing device.
- **PLUMBING:** Provide shower stalls, lavatories, and water closets. A floor drain is required in this area that shall be self priming, or designed to prevent sewer gases from entering the occupied space by a proven and maintenance-free design. Provide a hot water hose bibb under sink area to assist in disinfection.  
One-Company Station: Provide 2 water closets, 2 showers, and 2 lavatories.  
Two-Company Station: Provide 4 water closets, 4 showers, and 3 lavatories.  
Three-Company Station: Provide 4 water closets, 4 showers, and 4 lavatories.
- **HVAC:** Provide per current codes.
- **FIRE PROTECTION:** Provide per current codes.
- **ELECTRICAL:** Provide outlets per current codes.

## Standard Design Criteria Fire Stations

- **LIGHTING:** Provide per current codes.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. None required.
  - PA/Audio. Speaker required.
  - Telephone. None required.
  - Data. None required.
  - Security. None required.
- **ACOUSTICS:** None.
- **CASEWORKS/BUILT-IN EQUIPMENT:** Provide 24-in deep minimum solid surface materials for countertops. Provide 24-in deep minimum resin based materials for showers, urinals, and toilet partitions.
- **SPECIAL REQUIREMENTS:** None.

## Standard Design Criteria

### Fire Stations

#### 40. SPACE: Women Bathroom/Showers/Changing

- **FUNCTIONAL DESCRIPTION:** This area shall contain private water closets, lavatory and shower stalls with private changing areas for firefighters.
- 
- **ADJACENCIES:** This area is in the Living Area of the Fire Station. Shall be directly accessible from the corridor in the Living Area.
- **OCCUPANTS:** Fire Station Staff.
- **MINIMUM AREA:**  
All Fire Stations: 150 SF, Net.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide slip resistant ceramic tile. Floors shall be able to withstand the warm humid environment and shall be able to keep water from getting under the flooring material. Salient characteristics include durable and easy to clean, repairable, easy to maintain, and slip resistant. A base material, appropriate for the flooring material used, is required. Base shall be sealed to the flooring.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide moisture and mildew resistant gypsum wall board. Provide a full-height hard tile finish on all walls that is impervious to water and shall be able to withstand daily sanitizing. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE.** Provide skim-coated cementitious backer board ceiling. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Doors shall be provided with self-closing device.
- **PLUMBING:** Provide shower stalls, lavatories, and water closets. A floor drain is required in this area that shall be self priming, or designed to prevent sewer gases from entering the occupied space by a proven and maintenance-free design. Provide a hot water hose bibb under sink area to assist in disinfection.  
All Fire Stations: Provide 1 water closet, 1 shower, and 1 lavatory.
- **HVAC:** Provide per current codes.
- **FIRE PROTECTION:** Provide per current codes.
- **ELECTRICAL:** Provide outlets per current codes.
- **LIGHTING:** Provide per current codes.
- **COMMUNICATION:**  
CCTV. None required.

## Standard Design Criteria Fire Stations

CATV/Internal Video. None required.

PA/Audio. Speaker required.

Telephone. None required.

Data. None required.

Security. None required.

- **ACOUSTICS:** None.
- **CASEWORKS/BUILT-IN EQUIPMENT:** Provide 24-in deep minimum solid surface materials for countertops. Provide 24-in deep minimum resin based materials for showers and toilet partitions.
- **SPECIAL REQUIREMENTS:** None.

## Standard Design Criteria Fire Stations

### 41. SPACE: Fitness Room

- **FUNCTIONAL DESCRIPTION:** The room shall accommodate fitness machines, treadmill, stationary bicycle, elliptical machine, free weights and mats. Room shall be sized to provide free circulation.
- **ADJACENCIES:** This area is in the Living Area of the Fire Station. Shall be directly accessible from the corridor in the Living Area and shall be adjacent to, or in the proximity of, the Bathroom/Showers/Changing area.
- **OCCUPANTS:** Fire Station Staff.
- **MINIMUM AREA:** 437 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. Consider a cork, sports, or rubberized flooring system. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide moisture resistant acoustical ceiling panels (ACP) or gypsum wall board (GWB) with egg-shell paint. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be a minimum of half-height glass and shall be provided with a minimum 24" wide sidelite. Doors shall be provided with self-closing device.
- **OBSERVATION WINDOW/FRAME:** Salient characteristics include durability.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes. In addition, provide 68 F (20 C) minimum, 74 F (23 C) maximum, less than 60% relative humidity, 20 cfm/person outside air and use CO2 sensors to control outside air. Provide multi-speed ceiling fans.
- **FIRE PROTECTION:** Provide per current codes. Provide carbon monoxide and smoke detectors.
- **ELECTRICAL:** Provide outlets per current codes and provide wall or floor outlets to accommodate fitness machines such as treadmills, bikes, and stair-step machines.

## Standard Design Criteria Fire Stations

- **LIGHTING:** Provide per current codes.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. Provide at least one outlet in for wall mounted unit.
  - PA/Audio. Provide speaker.
  - Telephone. Provide one line with internal two-way communication.
  - Data. None required.
  - Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** Provide full-wall-height mirrors on at least one wall.
- **SPECIAL REQUIREMENTS:** None.



## Standard Design Criteria

### Fire Stations

#### 42. **SPACE: Additional Toilet/Shower** (Headquarters Fire Stations only).

- **FUNCTIONAL DESCRIPTION:** This area shall be lavatory, water closet, and shower area for Fire Station staff.
- **ADJACENCIES:** This area is in the Living Area of the Fire Station. Shall be directly accessible from the corridor in the Living Area.
- **OCCUPANTS:** Fire Station Staff.
- **MINIMUM AREA:** 60 SF, Net.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Floors shall be able to withstand the warm humid environment and shall be able to keep water from getting under the flooring material. Salient characteristics include durable and easy to clean, repairable, easy to maintain, and slip resistant. A base material, appropriate for the flooring material used, is required. Base shall be sealed to the flooring.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Providing moisture and mildew resistant gypsum wall board. Provide a low-maintenance finish such as egg-shell latex paint. On all walls, a minimum 48" tall wainscot is required that is impervious to water and be able to withstand daily sanitizing. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide moisture resistant gypsum board ceiling. Consider semi-gloss industrial paint. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device.
- **PLUMBING:** Provide water closet, shower, and lavatory. A floor drain is required in this area that shall be self priming, or designed to prevent sewer gases from entering the occupied space by a proven and maintenance-free design.
- **HVAC:** Provide per current codes. Local exhaust vent above toilet.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes.
- **LIGHTING:** Provide per current codes.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. None required.
  - PA/Audio. None required.
  - Telephone. None required.

## **Standard Design Criteria Fire Stations**

Data. None required.

Security. None required.

- **ACOUSTICS:** None.
- **CASEWORKS/BUILT-IN EQUIPMENT:** Provide 24-in deep minimum solid surface materials for countertops. Provide 24-in deep minimum resin based materials for shower.
- **SPECIAL REQUIREMENTS:** None.

## Standard Design Criteria Fire Stations

### 43. SPACE: Laundry Room

- **FUNCTIONAL DESCRIPTION:** This room shall accommodate large heavy duty commercial washers and dryers, built-in laundry-folding table and wall-mounted drying rack for the firefighters' personal use.
- **ADJACENCIES:** This area is in the Living Areas of the Fire Station. Shall be directly accessible from the corridor in the Living areas.
- **OCCUPANTS:** Fire Station Staff.
- **MINIMUM AREA:**  
One Company: 80 SF, Net.  
Two Company: 160 SF, Net.  
Three Company: 240 SF, Net.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Floors shall be able to withstand the warm humid environment and shall be able to keep water from getting under the flooring material. Salient characteristics include durable and easy to clean, repairable, easy to maintain, and slip resistant. A base material, appropriate for the flooring material used, is required. Base shall be sealed to the flooring.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Providing moisture and mildew resistant gypsum wall board. Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide moisture resistant acoustical ceiling panels (ACP) or moisture resistant gypsum wall board (GWB) with semi-gloss latex paint. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be a minimum of half-height glass. Doors shall be provided with self-closing device.
- **PLUMBING:** Provide water supply and drain to each washer. Provide a deep laundry sink. A floor drain is required in this area that shall be self priming, or designed to prevent sewer gases from entering the occupied space by a proven and maintenance-free design.
- **HVAC:** Provide per current codes.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes. Provide an additional outlet at the folding table.

## Standard Design Criteria Fire Stations

- **LIGHTING:** Provide per current codes.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. None required.
  - PA/Audio. Provide a speaker.
  - Telephone. None required.
  - Data. None required.
  - Security. None required.
- **ACOUSTICS:** None.
- **CASEWORKS/BUILT-IN EQUIPMENT:** Provide a built-in laundry-folding table and wall-mounted drying rack.
- **SPECIAL REQUIREMENTS:** Dryer vents shall be individually and directly vented to the outside. A booster fan will be provided in the dryer vent when the travel distance exceeds 20 feet to the exterior.

## Standard Design Criteria

### Fire Stations

#### 44. SPACE: Janitor's Closet

- **FUNCTIONAL DESCRIPTION:** This room shall be utilized to store janitor's equipment and cleaning supplies.
- **ADJACENCIES:** This area is in the Living Area of the Fire Station. Shall be directly accessible from the corridor in the Living Area and shall be adjacent to, or in the proximity of, the Bathroom/Shower/Changing area. A Janitor's Room shall be provided on the first floor of a Two-Story Fire Station directly accessible from the Administrative Area's corridor also.
- **OCCUPANTS:** Fire Station Staff.
- **MINIMUM AREA:**  
One-Story Fire Station: 48 SF, Net.  
Two-Story Fire Station: 48 SF, Net- First Floor and 48 SF, Net- Second Floor
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Floors shall be able to keep water from getting under the flooring material. Salient characteristics include durable and easy to clean, repairable, easy to maintain, and slip resistant. A base material, appropriate for the flooring material used, is required. Base shall be sealed to the flooring.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Providing moisture and mildew resistant gypsum wall board. Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide moisture resistant acoustical ceiling panels (ACP) or gypsum wall board (GWB) with semi-gloss latex paint. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device.
- **PLUMBING:** A utility (mop) sink is required. A floor drain is required in this area that shall be self priming, or designed to prevent sewer gases from entering the occupied space by a proven and maintenance-free design.
- **HVAC:** Provide per current codes. Local exhaust vent required.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes.
- **LIGHTING:** Provide per current codes.

## Standard Design Criteria Fire Stations

- **COMMUNICATION:**  
CCTV. None required.  
CATV/Internal Video. None required.  
PA/Audio. None required.  
Telephone. None required.  
Data. None required.  
Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 45.
- **CASEWORKS/BUILT-IN EQUIPMENT:** Adjustable with heavy duty standards and brackets shelves will be provided on at least one wall. Shelves shall be able to support 100 pounds per lineal foot.
- **SPECIAL REQUIREMENTS:** None.

## Standard Design Criteria

### Fire Stations

#### 45. **SPACE: Recreation Room** (Headquarters Fire Stations only).

- **FUNCTIONAL DESCRIPTION:** This area accommodates up to two "game units", such as pool tables, foosball tables, ping pong tables or video game consoles. Provide some acoustical separation from the Day/Training Room and the Dorm Rooms.
- **ADJACENCIES:** This area is in the Living Area of the Fire Station. Shall be directly accessible from the corridor in the Living Area and shall be adjacent to, or in the proximity of, the Day/Training Room.
- **OCCUPANTS:** Fire Station Staff.
- **MINIMUM AREA:** 420 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP) or gypsum wall board (GWB) with egg-shell paint. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be a minimum of half-height glass. Doors shall be provided with self-closing device.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes. Consider providing independent thermostat.
- **FIRE PROTECTION:** Provide per current codes. Provide carbon monoxide and smoke detectors.
- **ELECTRICAL:** Provide outlets per current codes. Provide power required to accommodate any game equipment.
- **LIGHTING:** Provide per current codes. Provide 50 ft. candles (540 Lux) with incandescent energy efficient light fixtures. Consider residential-style lighting fixtures. Consider providing dimmer for all light fixtures.

## Standard Design Criteria Fire Stations

- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. Provide at least one outlet. Consider height of outlet for a wall mounted television.
  - PA/Audio. Provide speaker.
  - Telephone. Provide one line with internal two-way communication.
  - Data. None required.
  - Security. None required.
- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 52.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None.
- **SPECIAL REQUIREMENTS:** None.



## Standard Design Criteria Fire Stations

### 46. SPACE: Corridor

- **FUNCTIONAL DESCRIPTION:** Main Circulation Space.
- **ADJACENCIES:** Through Fire Station.
- **OCCUPANTS:** Fire Station Staff.
- **MINIMUM AREA:**  
One-Story Fire Station: Portion of Net-To-Gross Ratio= 22%.  
Two-Story Fire Station: Portion of Net-To-Gross Ratio= 30%.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. Consider providing vinyl wall coverings.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP) or gypsum wall board (GWB) with egg-shell paint. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Provide 3 foot by 7 foot doors, fitted with a locking mechanism and flush panic hardware at the entry/exits. Provide doors, fitted with passage hardware at the transitions doors. To ensure visibility, doors shall have vision panels. Doors shall be provided with self-closing device.
- **PLUMBING:** Provide water for electric water coolers.
- **HVAC:** Provide per current codes.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes. Consider outlets for display cases.
- **LIGHTING:** Provide per current codes. Provide 20 ft. candles (215 Lux) with fluorescent energy efficient light fixtures.
- **COMMUNICATION:**  
CCTV. Provide at least one outlet.  
CATV/Internal Video. None required.  
PA/Audio. Provide speaker.

## Standard Design Criteria Fire Stations

Telephone. None required

Data. None required.

Security. None required.

- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 45.
- 
- **CASEWORKS/BUILT-IN EQUIPMENT:** None
- **SPECIAL REQUIREMENTS:** Corridor SHALL have a minimum clear width of NO LESS THAN 5'-0" in the Living Area. Corridor SHALL have a minimum clear width of NO LESS THAN 6'-0" in the Administration and Training areas. An ABA compliant bi-level electric water cooler shall be provided in the Administration and Training areas. An electric water cooler shall be provided in the Living Area.

## Standard Design Criteria

### Fire Stations

#### 47. SPACE: Vending

- **FUNCTIONAL DESCRIPTION:** This area accommodates for two or more vending machines for snacks and drinks.
- **ADJACENCIES:** One location off of Corridor. Can be located in the Recreation Room.
- **OCCUPANTS:** Fire Station Staff.
- **MINIMUM AREA:** 40 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. Consider providing vinyl wall coverings.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP) or gypsum wall board (GWB) with egg-shell paint. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Provide 3 foot by 7 foot doors, fitted with a locking mechanism and flush panic hardware at the entry/exits. Provide doors, fitted with passage hardware at the transitions doors. To ensure visibility, doors shall have vision panels. Doors shall be provided with self-closing device.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes.
- **FIRE PROTECTION:** Provide per current codes.
- **ELECTRICAL:** Provide outlets per current codes. Provide outlets and power required by vending machines.
- **LIGHTING:** Provide per current codes. Provide 20 ft. candles (215 Lux) with fluorescent energy efficient light fixtures.
- **COMMUNICATION:**  
CCTV. Provide at least one outlet.  
CATV/Internal Video. None required.  
PA/Audio. Provide speakers and horns with visual element.

## **Standard Design Criteria Fire Stations**

Telephone. None required.

Data. None required.

Security. None required.

- **ACOUSTICS:** None.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None
- **SPECIAL REQUIREMENTS:** None

## Standard Design Criteria Fire Stations

### 48. **SPACE: Emergency Operations Center** (Installation Requirement Only).

- **FUNCTIONAL DESCRIPTION:** This area, as dictated by Installation mission requirements is a specialized conference room used in cases of major operations to manage and coordinate rescue and emergency service efforts. It should be set up to handle planned and ad-hoc meetings and a high volume of telephone and computer communications.
- **ADJACENCIES:** Locate EOC Situation Room in an interior area of the building, adjacent to the Dispatch. Classified information may be accessed in this room.
- **OCCUPANTS:** EOC Staff.
- **MINIMUM AREA:** Per Room: 320 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. Consider providing durable commercial carpeting. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. Consider providing vinyl wall coverings.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP). Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Provide doors, fitted with a locking mechanism and flush panic hardware at the entry/exit. Doors shall be provided with self-closing device.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes and to support all equipment.
- **LIGHTING:** Provide per current codes.
- **COMMUNICATION:**  
CCTV. Provide outlets required to support equipment.

## Standard Design Criteria

### Fire Stations

CATV/Internal Video. Provide outlets required to support equipment.

PA/Audio. Provide a speaker and a microphone.

Telephone. Provide regular and secure multi-telephone line required to support telephone and fax.

Data. Provide regular and secure data outlets to support required equipment.

Security. None required.

- **ACOUSTICS:** Provide partition and door construction with a minimum STC rating of 49.
- 
- **CASEWORKS/BUILT-IN EQUIPMENT:** Provide a retractable projector screen and overhead projector mount. Consider providing built-in case work such as a counter and base cabinets.
- **SPECIAL REQUIREMENTS:** If classified information at SECRET level shall be accessed in this room, address security, visibility, and data handling issues in accordance with the USAISEC Technical Guide for the Integration of SIPRNET and AR 380-5.

## Standard Design Criteria Fire Stations

### 49. SPACE: Recycle Room/Space

- **FUNCTIONAL DESCRIPTION:** An accessible area that serves the entire building and is dedicated to the collection and storage of non-hazardous materials for recycling, including at a minimum: paper, corrugated cardboard, glass, plastics, and metals.
- **ADJACENCIES:** Shall be directly accessible from the corridor of the Fire Station.
- **OCCUPANTS:** Fire Station Staff.
- **MINIMUM AREA:** 20 SF, Net.
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide low maintenance sheet or tile vinyl flooring material. Salient characteristics include durable and easy to clean, repairable, and easy to maintain. A base material, appropriate for the flooring material used, is required.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include durable and easy to clean, repairable, and easy to maintain.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide acoustical ceiling panels (ACP) or gypsum wall board (GWB) with egg-shell paint. Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Shall be fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors shall be provided with self-closing device.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes.
- **FIRE PROTECTION:** Provide per current codes. Provide a smoke detector.
- **ELECTRICAL:** Provide outlets per current codes.
- **LIGHTING:** Provide per current codes.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. None required.
  - PA/Audio. Provide speaker.
  - Telephone. None required.
  - Data. None required.
  - Security. None required.

## **Standard Design Criteria Fire Stations**

- **ACOUSTICS:** None.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None.
- **SPECIAL REQUIREMENTS:** The Recycle Room/Space only has to be a space. It can be allocated within another Fire Station's room.



## Standard Design Criteria Fire Stations

### 50. SPACE: Mechanical Room

- **FUNCTIONAL DESCRIPTION:** This area supports the Fire Station's mechanical functions.
- **ADJACENCIES:** Shall be directly accessible from the service drive.
- **OCCUPANTS:** Fire Station's mechanical equipment.
- **MINIMUM AREA:**  
One-Story Fire Station: Portion of Net-To-Gross Ratio= 22%.  
Two-Story Fire Station: Portion of Net-To-Gross Ratio= 30%.
- **CEILING HEIGHT:** Provide per current codes.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide per current codes.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide per current codes.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE** Provide per current codes.
- **DOORS/FRAME:** Salient characteristics include durability. Provide a set of double 3 foot by 7 foot doors, fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors, frames, and hardware shall be able to withstand constant opening and closing. Doors shall be provided with self-closing device.
- **PLUMBING:** Provide per current codes.
- **HVAC:** Provide per current codes.
- **FIRE PROTECTION:** Provide per current codes.
- **ELECTRICAL:** Provide outlets per current codes.
- **LIGHTING:** Provide per current codes.
- **COMMUNICATION:**  
CCTV. None required.  
CATV/Internal Video. None required.  
PA/Audio. None required.  
Telephone. None required.  
Data. None required.  
Security. None required.
- **ACOUSTICS:** Provide per current codes.

**Standard Design Criteria  
Fire Stations**

- **CASEWORKS/BUILT-IN EQUIPMENT:** None.
- **SPECIAL REQUIREMENTS:** Provide per current codes.

## Standard Design Criteria Fire Stations

### 51. SPACE: Electrical Room

- **FUNCTIONAL DESCRIPTION:** This area supports the Fire Station's electrical functions.
- **ADJACENCIES:** Shall be directly accessible from the service drive.
- **OCCUPANTS:** Fire Station's electrical equipment.
- **MINIMUM AREA:**  
One-Story Fire Station: Portion of Net-To-Gross Ratio= 22%.  
Two-Story Fire Station: Portion of Net-To-Gross Ratio= 30%.
- **CEILING HEIGHT:** Provide per current codes.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Provide per current codes.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide per current codes.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE** Provide per current codes.
- **DOORS/FRAME:** Salient characteristics include durability. Provide a 3 foot by 7 foot door, fitted with a locking mechanism and lever type handle that allows the door to be opened from the inside while locked. Doors, frames, and hardware shall be able to withstand constant opening and closing. Doors shall be provided with self-closing device.
- **PLUMBING:** Provide per current codes.
- **HVAC:** Provide per current codes.
- **FIRE PROTECTION:** Provide per current codes.
- **ELECTRICAL:** Provide outlets per current codes.
- **LIGHTING:** Provide per current codes.
- **COMMUNICATION:**  
CCTV. None required.  
CATV/Internal Video. None required.  
PA/Audio. None required.  
Telephone. None required.  
Data. None required.  
Security. None required.
- **ACOUSTICS:** Provide per current codes.

**Standard Design Criteria  
Fire Stations**

- **CASEWORKS/BUILT-IN EQUIPMENT:** None.
- **SPECIAL REQUIREMENTS:** Provide per current codes.

## Standard Design Criteria Fire Stations

### 52. SPACE: Patio

- **FUNCTIONAL DESCRIPTION:** This area shall be provided for firefighters to relax and grill.
- **ADJACENCIES:** Shall be adjacent to and with direct access to the Dayroom/Training Room.
- **OCCUPANTS:** Fire Station Staff.
- **MINIMUM AREA:**  
One or Two Company Fire Station: 150 SF, Net.  
Three Company Fire Station: 250 SF, Net.
- **CEILING HEIGHT:** None.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:**  
Concrete. Consider brick or stone paver accents.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** None.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE** None. Consider providing shade structures.
- **DOORS/FRAME:** None.
- **PLUMBING:** Provide per current codes. Provide hose bibb and if natural gas is available provide a gas connection for an external grill.
- **HVAC:** None.
- **FIRE PROTECTION:** None. If an attached awning is provided, refer to NFPA 13 for the requirements.
- **ELECTRICAL:** Provide exterior outlets per current codes. Provide minimum of four weatherproof GFCI outlets.
- **LIGHTING:** Provide per current codes. Provide .5 ft. candles (11 Lux) with energy efficient outdoor light fixtures.
- **COMMUNICATION:**  
CCTV. None required.  
CATV/Internal Video. None required.  
PA/Audio. Provide a speaker.  
Telephone. None required.  
Data. None required.  
Security. None required.
- **ACOUSTICS** None.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None.

**Standard Design Criteria  
Fire Stations**

- **SPECIAL REQUIREMENTS:** None.

## Standard Design Criteria Fire Stations

### 53. SPACE: Canopy

- **FUNCTIONAL DESCRIPTION:** This area shall be provided for weather protection at the main entrance to the Fire Station
- **ADJACENCIES:** Shall be directly off of the Lobby entrance of the Fire Station.
- **OCCUPANTS:** Fire Station Staff.  
  
**MINIMUM AREA:** 40 SF, Net. (Half of 80 SF, per US Army Technical Instructions 800-01 (TI 800-01), Design Criteria).
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Concrete. Consider brick or stone paver accents.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** None.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Salient characteristics include durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** None.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes.
- **FIRE PROTECTION:** Provide per current codes.
- **ELECTRICAL:** Provide outlets per current codes.
- **LIGHTING:** Provide per current codes.
- **COMMUNICATION:**  
CCTV. None required.  
CATV/Internal Video. None required.  
PA/Audio. Provide speaker.  
Telephone. None required.  
Data. None required.  
Security. None required.
- **ACOUSTICS:** None.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None.
- **SPECIAL REQUIREMENTS:** None.

## Standard Design Criteria

### Fire Stations

#### 54. **SPACE: Vestibule** (As required by geographical location, in lieu of the Canopy).

- **FUNCTIONAL DESCRIPTION:** This area serves as the entrance/exit to the facility. The Vestibule should be recognizable from the outside as a well-lit, inviting space.
- **ADJACENCIES:** This area is in the Administrative Office area of the Fire Station and is the main entrance into the Fire Station.
- **OCCUPANTS:** Fire Station Visitors.
- **MINIMUM AREA:** Each: 80 SF, Net
- **CEILING HEIGHT:** 8 ft. minimum.
- **MINIMUM FLOOR and BASE CONSTRUCTION/SURFACE PERFORMANCE:** Salient characteristics include easy to clean, maintain, and repair. A base material, appropriate for the flooring material used, is required. Consider stone or quarry tile with stone or tile base.
- **MINIMUM WALL CONSTRUCTION/SURFACE PERFORMANCE:** Provide a low-maintenance finish such as egg-shell latex paint. Salient characteristics include easy to repair, easy to maintain, and durable. Consider providing vinyl wall coverings.
- **MINIMUM CEILING CONSTRUCTION/SURFACE PERFORMANCE:** Provide decorative acoustical ceiling panels (ACP). Salient characteristics include ease of accessibility to mechanical system above ceiling, durable, and shall provide an aesthetically pleasing surface, free of sags or other defects.
- **DOORS/FRAME:** Salient characteristics include durability. Doors, frames, and hardware shall be able to withstand constant opening and closing. Provide a set of storefront double 3 foot by 7 foot doors, fitted with a locking mechanism and flush panic hardware at the entry. To ensure maximum visibility, doors shall be fully glazed. Doors shall be provided with self-closing device.
- **PLUMBING:** None.
- **HVAC:** Provide per current codes.
- **FIRE PROTECTION:** Provide per current codes.
- **ELECTRICAL:** Provide outlets per current codes.
- **LIGHTING:** Provide per current codes. Consider decorative lighting fixtures and task lighting.
- **COMMUNICATION:**
  - CCTV. None required.
  - CATV/Internal Video. None required.
  - PA/Audio. None required.
  - Telephone. None required.
  - Data. None required.



## **Standard Design Criteria Fire Stations**

Security. None required.

- **ACOUSTICS:** None.
- **CASEWORKS/BUILT-IN EQUIPMENT:** None
- **SPECIAL REQUIREMENTS:**  
Provide airlock at main entrance when necessary.  
  
Consider a recessed, built-in mat at entry.

**Standard Design Criteria  
Fire Stations****55. SPACE: Site/Building Exterior**

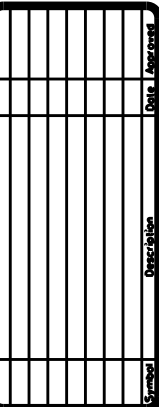
- The layout of the parking lot and traffic circulation must consider the safety of the Fire Station staff and visitors when entering and departing the facility. Access drives to staff and public parking should not cross the vehicle access drive out of the Apparatus Bay. If the parking lot design requires crosswalks, as a minimum, these must be painted and identifiable with signage in appropriate locations to ensure the safety of the personnel and visitors.
- Provide parking for authorized Fire Station staff. Parking area shall be sized to accommodate two shifts. Visitor parking shall be separate from staff parking.
- All sidewalks must be ABA compliant.

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	Submitted by:	Drawing code:	
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	CE HMC-ED-SC-A		
	Plot date:		
	30 JAN 2009		

FOR  
SATELLITE FIRE STATION

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number:  
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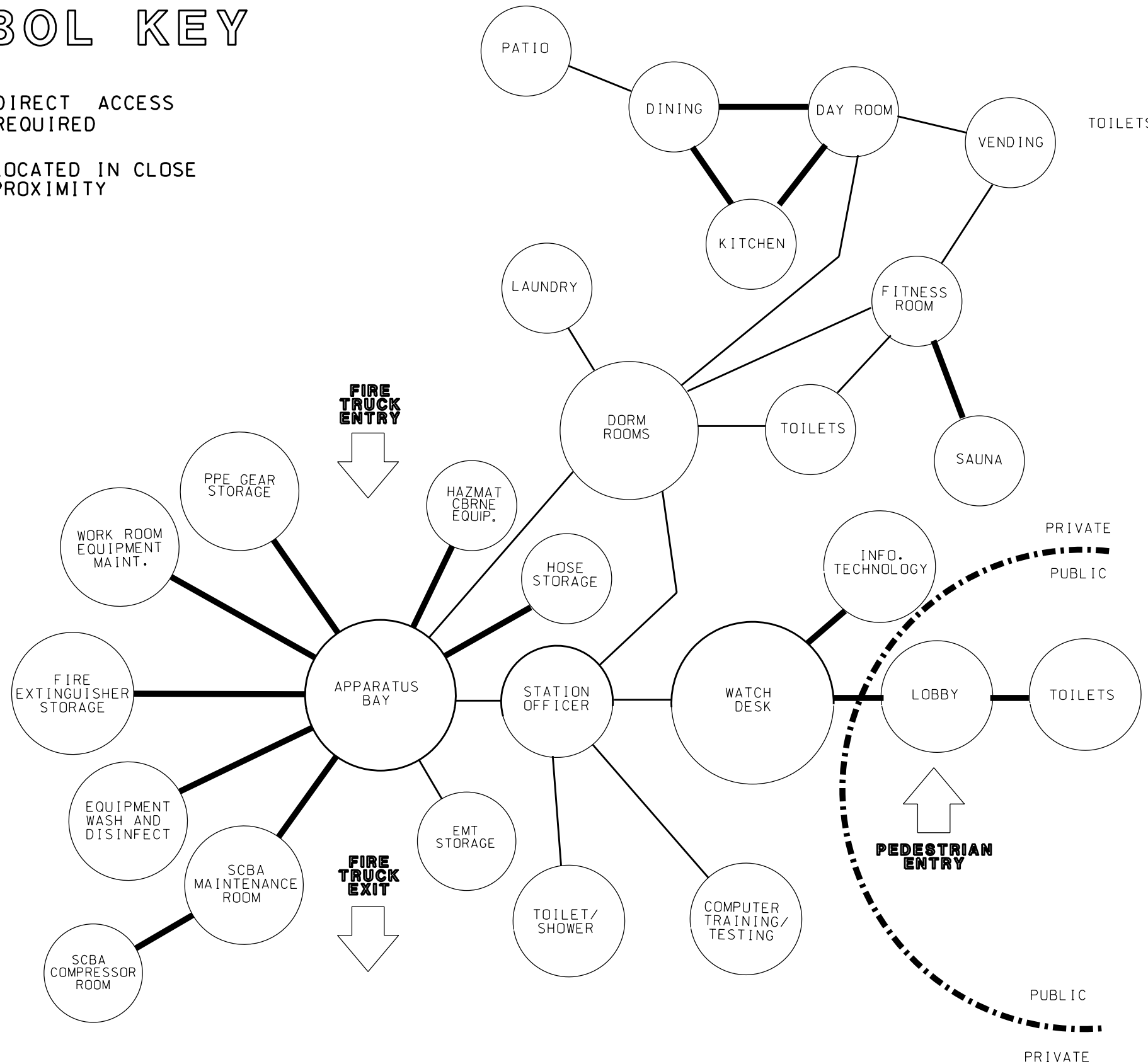
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	<b>Revised by:</b> CE HMC-ED-SC-A <b>Submitted by:</b> CE HMC-ED-SC-A	<b>Drawing code:</b> <b>File name:</b> <b>Post date:</b> 30 JAN 2008 <b>Post score:</b>

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FOR  
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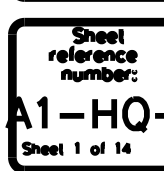
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**\_\_\_\_\_ DIRECT ACCESS  
REQUIRED**

**\_\_\_\_\_ LOCATED IN CLOSE  
PROXIMITY**



# CONCEPT DESIGN SATELLITE FIRE STATION



	ONE COMPANY HEADQUARTERS FIRESTATION		TWO COMPANY HEADQUARTERS FIRESTATION		THREE COMPANY HEADQUARTERS FIRESTATION	
Functional Component	NEW ARMY DESIGN STANDARD SQ. FT.	REQUIRED STANDARD SQ. FT.	NEW ARMY DESIGN STANDARD SQ. FT.	REQUIRED STANDARD SQ. FT.	NEW ARMY DESIGN STANDARD SQ. FT.	REQUIRED STANDARD SQ. FT.
Apparatus Bay (Varies by Installation)	4,095	4,095	5,642	5,642	5,642	5,642
Apparatus Equipment and Maintenance						
Station Captain's Suite	205	120	205	120	205	120
Station Captain's Dorm Room	In Station Captain's Suite	85	In Station Captain's Suite	85	In Station Captain's Suite	85
Personal Protection Equip. (PPE) Stor.	In Apparatus Bay	200	In Apparatus Bay	300	In Apparatus Bay	400
Hose Storage	In Apparatus Bay	54	In Apparatus Bay	54	In Apparatus Bay	54
SCBA Maintenance Room	161	144	161	144	252	144
SCBA Compressor Room	61	50	61	50	61	50
Protective Clothing Laundry	109	100	109	100	171	150
Equipment Wash/ Disinfection	206	150	230	150	263	150
Work Room/ Equipment Maintenance	197	120	197	120	212	120
EMT Storage (incl. Lockable Med. Cabinet)	In HAZMAT/ CBRNE Equip. Stor.	25	In HAZMAT/ CBRNE Equip. Stor.	25	In HAZMAT/ CBRNE Equip. Stor.	25
HAZMAT/ CBRNE Equipment Stor.	447	240	447	360	624	480
Logistics' Office	In HAZMAT/ CBRNE Equip. Stor.	80	In HAZMAT/ CBRNE Equip. Stor.	80	In HAZMAT/ CBRNE Equip. Stor.	80
Fire Extinguisher Inspection (Flight Line/Non Flight Line)	150	160	169	160	194	160
Sum of Apparatus Equip.t and Maint. (Net)	1536	1528	1579	1748	1982	2018
Administration and Training						
Fire Chief's Suite	396	200	396	200	396	200
Fire Chief's Dorm Room	In Fire Chief's Suite	85	In Fire Chief's Suite	85	In Fire Chief's Suite	85
Fire Chief's Toilet	In Fire Chief's Suite	60	In Fire Chief's Suite	60	In Fire Chief's Suite	60
Chief's Conference Room	273	240	273	240	273	240
Deputy Chief's Office	143	120	143	120	143	120
Station's Officer's Office/Watch Desk	-----	-----	-----	-----	-----	-----
Assistant Chief/ Shift Supervisor's Suite	272	120	272	120	272	120
Assistant Chief/ Shift Supervisor's Dorm Room	In Asst. Chief/ Shift Supv.'s Suite	85	In Asst. Chief/ Shift Supv.'s Suite	85	In Asst. Chief/ Shift Supv.'s Suite	85
Assistant Chief/ Shift Supervisor's Toilet	In Asst. Chief/ Shift Supv.'s Suite	60	In Asst. Chief/ Shift Supv.'s Suite	60	In Asst. Chief/ Shift Supv.'s Suite	60
General Administration Storage	72	80	72	80	72	80
Lobby	204	100	204	100	204	100
Public ABA Toilet	60	48	60	48	60	48
Dispatch Suite	473	256	473	256	473	256
Dispatch Toilet	In Dispatch's Suite	48	In Dispatch's Suite	48	In Dispatch's Suite	48
Dispatch Kitchenette	In Dispatch's Suite	20	In Dispatch's Suite	20	In Dispatch's Suite	20
Information Technology/ (IT) room	In Dispatch's Suite	60	In Dispatch's Suite	60	In Dispatch's Suite	60
Telecommunication Room	134	180	134	180	134	180
Assistant Chief of Fire Protection's Office	130	120	130	120	130	120
Inspector(s)' Office	386	144	514	288	720	432
Training Officer's Office	126	100	126	100	126	100
Department Training Room	650	420	857	700	1,233	980
Training Room Storage	In Department Training Room	80	In Department Training Room	80	In Department Training Room	80
Computer Training/ Testing Room	282	190	282	190	282	190
EMS Office	91	80	91	80	91	80
HAZMAT/ Safety Office	120	120	120	120	120	120
Recycle Room/Space	140	20	196	20	180	20
Canopy- Half Square Footage	40	40	40	40	40	40
Sum of Apparatus Equip.t and Maint. (Net)	3992	3076	4383	3500	4949	3924
Living Area						
Day/Training Room	1,026	648	1,274	1,296	1,402	1,944
Dormitory Rooms	700	700	1,400	1,400	2,100	2,100
Men Bathrooms/Showers/Changing	226	250	344	325	344	350
Women Bathrooms/Showers/Changing	168	150	171	150	171	150
Fitness Room	437	437	437	437	437	437
Additional Toilet/Shower	88	60	88	60	88	60
Laundry Room	136	80	136	160	179	240
Janitor's Closet	56	48	56	48	56	48
Recreation Room	263	240	242	240	242	240
Vending	25	40	50	40	50	40
Sum of Apparatus Equip.t and Maint. (Net)	3,125	2653	4,198	4,156	5,069	5,609
Total Sq. Ft. of all spaces without the Apparatus Bay (Net)	8,653	7257	10,160	9,404	12,000	11,551
Total Sq. Ft. of all spaces with the Apparatus Bay (Net)	12,748	11,352	15,802	15,046	17,642	17,193
Net To Gross Factor (22%)		0.22		0.22		0.22
Mechanical Room	505		581		801	
Electrical Room	205		236		157	
Circulation and Wall Thickness						

## US Army Corps of Engineers

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	Designed by: CE HMC-ED-SC-A	Design file no.	Date: 00 JAN 2009
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**U.S. ARMY ENGINEERING AND  
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HUNTSVILLE, ALABAMA**


**FACILITIES STANDARDIZATION PROGRAM  
ARMY FIRE STATION DESIGN GUIDE**

## HEADQUARTERS FIRE STATION

### Steel reference numbers

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Sheet 1 of 14

# HEADQUARTER FIRE STATION SPACE PROGRAM DATA



US Army Corps of Engineers

Rev.	Date	By	Description
01	06 Jan 2009	CE W012DR-SC-A	Design file no.
02	07 Jan 2009	CE W012DR-SC-A	Design file no.
03	08 Jan 2009	CE W012DR-SC-A	Design file no.
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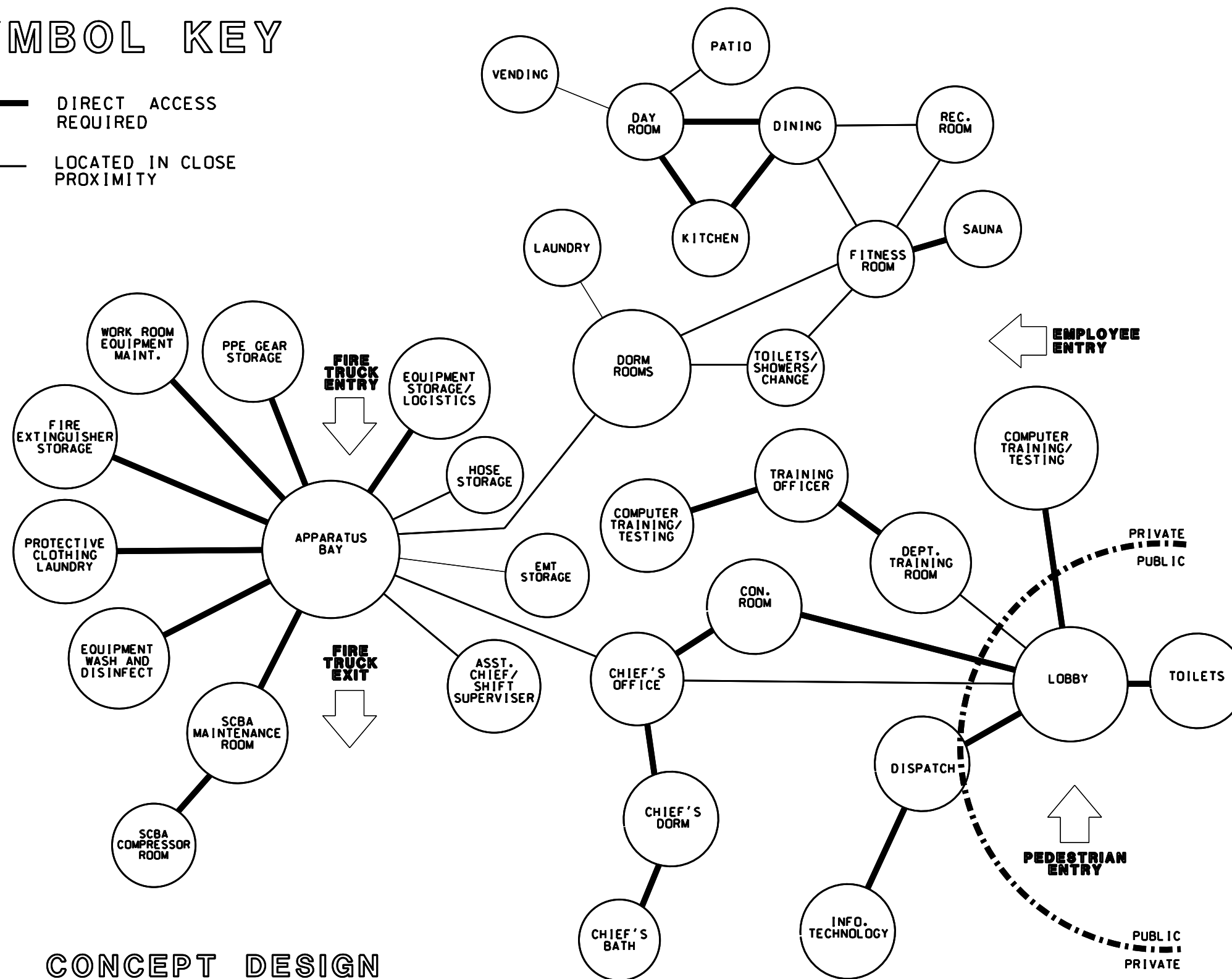
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ARMY FIRE STATION DESIGN GUIDE

FOR  
HEADQUARTERS FIRE STATION

Sheet reference number:  
**A2-HQ**  
Sheet 2 of 14

## SYMBOL KEY

- DIRECT ACCESS REQUIRED
- LOCATED IN CLOSE PROXIMITY



CONCEPT DESIGN  
HEADQUARTER FIRE STATION

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	Drawn by: ARCH. BRCH-DUMERNEY	Design file no.	
	Reviewed by: CE HMC-ED-SC-A	Drawing code:	
	Submitted by: CE HMC-ED-SC-A	File name:	
		Plot date:	30 JAN 2009

**DA FACILITIES STANDARDIZATION PROGRAM  
ARMY FIRE STATION DESIGN GUIDE  
FOR  
SATELLITE FIRE STATION**

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reference  
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# SATELLITE FIRE STATION SPACE PROGRAM DATA

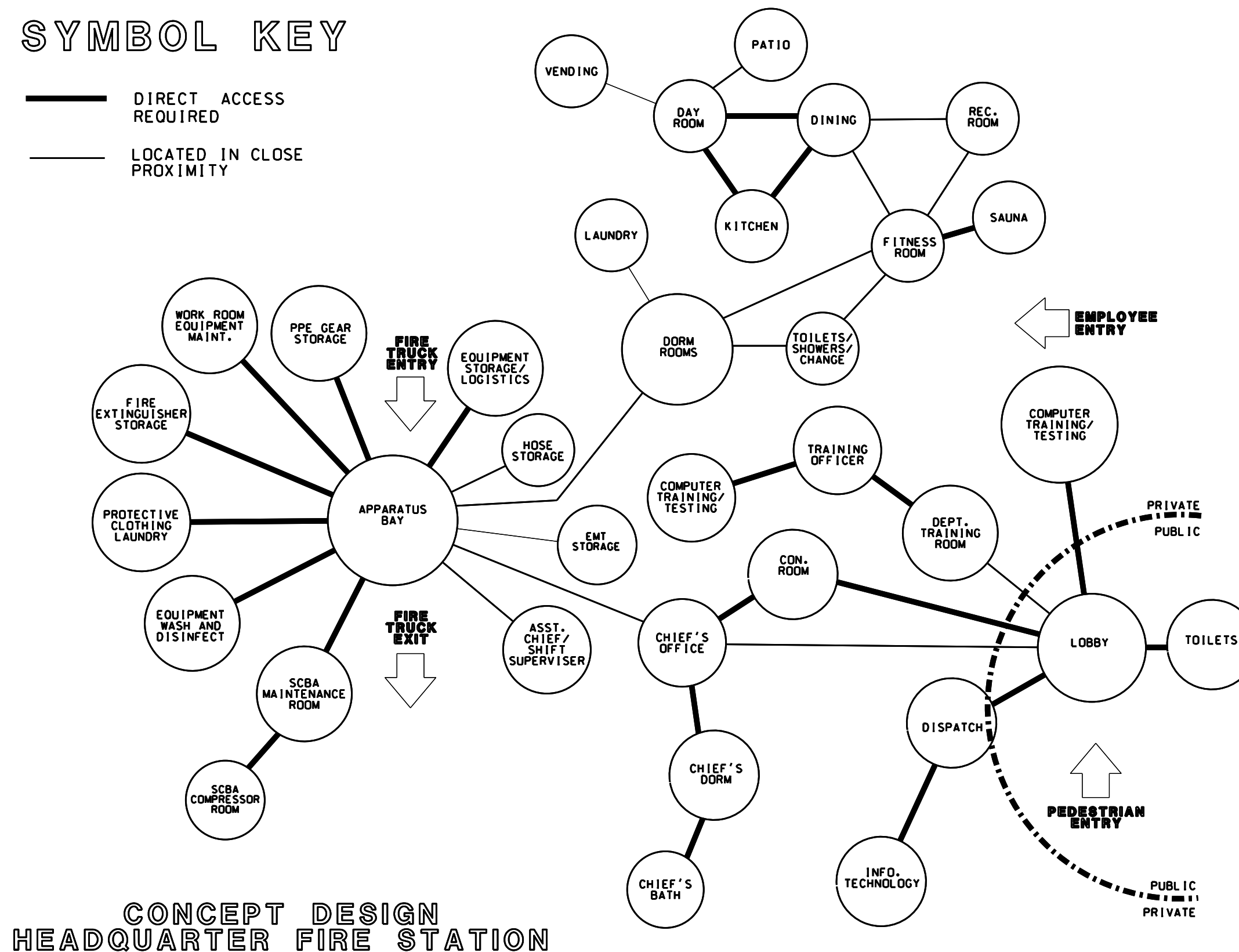


**US Army Corps  
of Engineers**

## SYMBOL KEY

———— DIRECT ACCESS  
REQUIRED

———— LOCATED IN CLOSE  
PROXIMITY



# CONCEPT DESIGN HEADQUARTER FIRE STATION

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	Submitted by: <b>CE HMC-ED-SC-A</b>	File name <b>Plot date 30 JAN 2009</b>	

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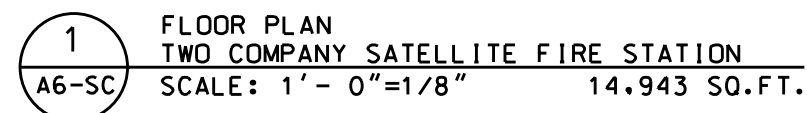
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FOR  
SATELLITE FIRE STATION

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FIRST FLOOR= 14.903 SF  
CANOPY= 40 SF  
GROSS TOTAL= 14.943 SF



#### 4.0 APPLICABLE CRITERIA

Unless a specific document version or date is indicated, use criteria from the most current references, including any applicable addenda, unless otherwise stated in the contract or task order, as of the date of the Contractor's latest accepted proposal or date of issue of the contract or task order solicitation, whichever is later. In the event of conflict between References and/or Applicable Military Criteria, apply the most stringent requirement, unless otherwise specifically noted in the contract or task order.

##### 4.1. INDUSTRY CRITERIA

Applicable design and construction criteria references are listed in Table 1 below. This list is not intended to include all criteria that may apply or to restrict design and construction to only those references listed. See also Paragraph 3 for additional facility-specific applicable criteria.

**Table 1: Industry Criteria**

<b>Air Conditioning and Refrigeration Institute (ARI)</b>	
ARI 310/380	Packaged Terminal Air-Conditioners and Heat Pumps
ARI 440	Room Fan-Coil and Unit Ventilator
ANSI/ARI 430-99	Central Station Air Handling Units
ARI 445	Room Air-Induction Units
ARI 880	Air Terminals
<b>Air Movement and Control Association (AMCA)</b>	
AMCA 210	Laboratory Methods of Testing Fans for Rating
<b>American Architectural Manufacturers Association (AAMA)</b>	
AAMA 605	Voluntary Specification Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels
AAMA 607.1	Voluntary Guide Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum
AAMA 1503	Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections
<b>American Association of State Highway and Transportation Officials (AASHTO)</b>	

	Roadside Design Guide [guardrails, roadside safety devices]
	Standard Specifications for Transportation Materials and Methods of Sampling and Testing [Road Construction Materials]
	Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals
	Guide for Design of Pavement Structures, Volumes 1 and 2 [pavement design guide]
	A Policy of Geometric Design of Highways and Streets
<b>American Bearing Manufacturers Association (AFBMA)</b>	
AFBMA Std. 9	Load Ratings and Fatigue Life for Ball Bearings
AFBMA Std. 11	Load Ratings and Fatigue Life for Roller Bearings
<b>American Boiler Manufacturers Association (ABMA)</b>	
ABMA ISEI	Industry Standards and Engineering Information
<b>American Concrete Institute</b>	
ACI 302.2R	Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials
ACI 318	Building Code Requirements for Structural Concrete
ACI SP-66	ACI Detailing Manual
ACI 530	Building Code Requirements for Masonry Structures
<b>ADA Standards for Accessible Design</b>	
See US Access Board	ADA and ABA Accessibility Guidelines for Buildings and Facilities, Chapters 3-10.
<b>American Institute of Steel Construction (AISC)</b>	
	Manual of Steel Construction – 13 <sup>th</sup> Edition (or latest version)

<b>American Iron and Steel Institute</b>	
AISI S100	North American Specification for the Design of Cold-Formed Steel Structural Members
<b>American National Standards Institute 11 (ANSI)</b>	
ANSI Z21.10.1	Gas Water Heaters Vol. 1, Storage water Heaters with Input Ratings of 75,000 Btu per Hour or less
ANSI Z124.3	American National Standard for Plastic Lavatories
ANSI Z124.6	Plastic Sinks
ANSI Z21.45	Flexible Connectors of Other Than All-Metal Construction for Gas Appliances
ANSI/IEEE C2	National Electrical Safety Code
ANSI/AF&PA NDS	National Design Specification for Wood Construction
<b>American Society of Civil Engineers (ASCE)</b>	
ASCE 7	Minimum Design Loads for Buildings and Other Structures
ASCE 37	Design and Construction of Sanitary and Storm Sewers, Manuals and Reports on Engineering Practice [sanitary sewer and storm drain design criteria]
ASCE/SEI 31-03	Seismic Evaluation of Existing Buildings [Existing Building Alteration/Renovation]
ASCE/SEI 41-06	Seismic Rehabilitation of Existing Buildings [Existing Building Alteration/Renovation]
<b>American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)</b>	
ASHRAE 90.1	ANSI/ASHRAE/IESNA 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings
ASHRAE Guideline 0	The Commissioning Process
ASHRAE Guideline 1.1	The HVAC Commissioning Process

ASHRAE Handbooks	Fundamentals, HVAC Applications, Systems and Equipment, Refrigeration (Applicable, except as otherwise specified)
ASHRAE Standard 15	Safety Standard for Refrigeration Systems
ASHRAE Standard 62.1	Ventilation for Acceptable Indoor Air Quality
ASHRAE Standard 55	Thermal Environmental Conditions for Human Occupancy (Design portion is applicable, except where precluded by other project requirements.)
ASHRAE Standard 189.1	<a href="#">Standard for the Design of High-Performance Green Buildings (ANSI Approved; USGBC and IES Co-sponsored)</a> , - (APPLICABLE TO THE EXTENT SPECIFICALLY CALLED OUT IN THE CONTRACT)
<b>American Society of Mechanical Engineers International (ASME)</b>	
ASME BPVC SEC VII	Boiler and Pressure Vessel Code: Section VII Recommended Guidelines for the Care of Power Boilers
ASME A17.1	Safety Code for Elevators and Escalators
ASME B 31 (Series)	Piping Codes
<b>American Water Works Association (AWWA)</b>	
	Standards [standards for water line materials and construction]
<b>American Welding Society</b>	
	Welding Handbook
	Welding Codes and Specifications (as applicable to application, see International Building Code for example)
<b>Architectural Woodwork Institute (AWI)</b>	
Latest Version	AWI Quality Standards
<b>Associated Air Balance Council (AABC)</b>	
AABC MN-1	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems

	AABC Associated Air Balance Council Testing and Balance Procedures
<b>ASTM International</b>	
ASTM C1060-90(	Standard Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings
ASTM E 779	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
ASTM E1827-96	Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door
<b>Builders Hardware Manufacturers Association (BHMA)</b>	
ANSI/BHMA	The Various BHMA American National Standards
<b>Building Industry Consulting Service International</b>	
	Telecommunications Distribution Methods Manual (TDMM)
	Customer-Owned Outside Plant Design Manual (CO-OSP)
<b>Code of Federal Regulations (CFR)</b>	
49 CFR 192	Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards
10 CFR 430	Energy Conservation Program for Consumer Products
<b>Consumer Electronics Association</b>	
CEA 709.1B	Control Network Protocol Specification
CEA 709.3	Free-Topology Twisted-Pair Channel Specification
CEA 852	Tunneling Component Network Protocols Over Internet Protocol Channels
<b>Electronic Industries Association (EIA)</b>	
ANSI/EIA/TIA 568	Structured Cabling Series

ANSI/EIA/TIA 569	Commercial Building Standard for Telecommunications Pathways and Spaces (includes ADDENDA)
ANSI/TIA/EIA-606	Administrative Standard for the Telecommunications Infrastructure of Commercial Buildings
J-STD EIA/TIA 607	Commercial Building Grounding and Bonding Requirements for Telecommunications
<b>Federal Highway Administration (FHWA)</b>	
	Manual on Uniform Traffic Control Devices for Streets and Highways [signage and pavement markings for streets and highways]
FHWA-NHI-01-021	Hydraulic Engineering Circular No. 22, Second Edition, URBAN DRAINAGE DESIGN MANUAL
<b>Illuminating Engineering Society of North America (IESNA)</b>	
IESNA RP-1	Office Lighting
IESNA RP-8	Roadway Lighting
IESNA Lighting Handbook	Reference and Application
<b>Institute of Electrical and Electronics Engineers Inc. (IEEE)</b>	
	Standard for Use of the International System of Units (SI): the Modern Metric System
Standard 1100	Recommended Practice for Powering and Grounding Sensitive Electronic Equipment
<b>International Code Council (ICC)</b>	
IBC	<p>International Building Code</p> <p>Note: All references in the International Building Code to the International Electrical Code shall be considered to be references to NFPA 70.</p> <p>All references in the International Building Code to the International Fuel Gas Code shall be considered to be references to NFPA 54 and NFPA 58.</p> <p>All references in the International Building Code to the International Fire</p>



	Code and Chapter 9 shall be considered to be references to Unified Facilities Criteria (UFC) 3-600-01.
IMC	International Mechanical Code –  Note: For all references to “HEATING AND COOLING LOAD CALCULATIONS”, follow ASHRAE 90.1  Note: For all references to “VENTILATION”, follow ASHRAE 62.1
IRC	International Residential Code
IPC	International Plumbing Code
IEC	Energy Conservation Code (IEC) –Applicable only to the extent specifically referenced herein. Refer to Paragraph 5, ENERGY CONSERVATION requirements.
IGC	International Gas Code - not applicable. Follow NFPA 54, National Fuel Gas Code and NFPA 58, Liquefied Petroleum Gas Code.
<b>International Organization for Standardization (ISO)</b>	
ISO 6781:1983	Qualitative detection of thermal irregularities in building envelopes – infrared method
<b>LonMark International (LonMark)</b>	
LonMark Interoperability Guidelines	(available at <a href="http://www.lonmark.org">www.lonmark.org</a> ), including: Application Layer Guidelines, Layer 1-6 Guidelines, and External Interface File (XIF) Reference Guide
LonMark Resource Files	(available at <a href="http://www.lonmark.org">www.lonmark.org</a> ), including Standard Network Variable Type (SNVT) definitions
<b>Metal Building Manufacturers Association (MBMA)</b>	
	Metal Building Systems Manual
<b>Midwest Insulation Contractors Association (MICA)</b>	
	National Commercial and Industrial Insulation Standards Manual
<b>National Association of Corrosion Engineers International (NACE)</b>	

NACE RP0169	Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NACE RP0185	Extruded, Polyolefin Resin Coating Systems with Adhesives for Underground or Submerged Pipe
NACE RP0285	Corrosion Control of Underground Storage Tank Systems by Cathodic Protection
NACE RP0286	Electrical Isolation of Cathodically Protected Pipelines
<b>National Electrical Manufacturers Association (NEMA)</b>	
<b>National Environmental Balancing Bureau (NEBB)</b>	
	Procedural Standards Procedural Standards for Testing Adjusting Balancing of Environmental Systems
<b>National Fire Protection Association (NFPA)</b>	
NFPA 10	Standard for Portable Fire Extinguishers
NFPA 13	Installation of Sprinkler Systems
NFPA 13R	Residential Occupancies up to and Including Four Stories in Height Sprinkler Systems
NFPA 14	Standard for the Installation of Standpipes and Hose Systems
NFPA 20	Installation of Centrifugal Fire Pumps
NFPA 24 NFPA 25	Standard for the Installation of Private Fire Service Mains and Their Appurtenances [underground fire protection system design]  Inspection, Testing And Maintenance Of Water-Based Fire Protection Systems
NFPA 30	Flammable and Combustible Liquids Code
NFPA 30A	Motor Fuel Dispensing Facilities and Repair Garages
NFPA 31	Installation of Oil Burning Equipment
NFPA 54	National Fuel Gas Code

NFPA 58	Liquefied Petroleum Gas Code
NFPA 70	National Electrical Code
NFPA 70E	Standard for Electrical Safety in the Workplace
NFPA 72	National Fire Alarm Code
NFPA 76	Fire Protection of Telecommunications Facilities
NFPA 80	Standard for Fire Doors and Fire Windows
NFPA 90a	Installation of Air Conditioning and Ventilating Systems
NFPA 96	Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
NFPA 101	Life Safety Code
NFPA 780	Standard for the Installation of Lightning Protection Systems
<b>National Roofing Contractor's Association (NRCA)</b>	
	Roofing and Waterproofing Manual
<b>National Sanitation Foundation, International</b>	
NSF/ANSI Std. 2, 3, 4, 5, 6, 7, 8, 12, 13, 18, 20, 21, 25, 29, 35, 36, 37, 51, 52, 59, 169	Food Equipment Standards
ANSI/UL Std. 73, 197, 471, 621, 763	Food Equipment Standards
CSA Std. C22.2 No. 109, 120, 195	Food Equipment Standards
<b>Occupational Safety and Health Administration (OSHA)</b>	
Title 29, Part 1926	OSHA Construction Industry Standards, Title 29, Code of Federal Regulations, Part 1926, Safety and Health Regulations for Construction

<b>Plumbing and Drainage Institute (PDI)</b>	
PDI G 101	Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data
PDI WH201	Water Hammer Arrestors
<b>Precast Concrete Institute</b>	
PCI Design Handbook	Precast and Prestressed Concrete
<b>Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)</b>	
SMACNA HVAC Duct Construction Standards	HVAC Duct Construction Standards - Metal and Flexible
SMACNA Architectural Manual	Architectural Sheet Metal Manual
SMACNA HVAC TAB	HVAC Systems - Testing, Adjusting and Balancing
<b>State/Local Regulations</b>	
	State Department of Transportation Standard Specifications for Highway and Bridge Construction
	Sedimentation and Erosion Control Design Requirements
	Environmental Control Requirements
	Storm Water Management Requirements
<b>Steel Door Institute (SDI)</b>	
ANSI A250.8/SDI 100	Standard Steel Doors and Frames
<b>Steel Deck Institute</b>	
	SDI Diaphragm Design Manual
<b>Steel Joist Institute</b>	
	Catalog of Standard Specifications and Load Tables for Steel Joists and

	Joist Girders
<b>Underwriters Laboratories (UL)</b>	
UL 96A	Installation Requirements for Lightning Protection Systems
UL 300	Standard for Safety for Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Areas
<b>UNITED STATES ACCESS BOARD: U.S. ARCHITECTURAL AND TRANSPORTATION BARRIERS COMPLIANCE BOARD</b>	
ADA and ABA Accessibility Guidelines for Buildings and Facilities	<p>ABA Accessibility Standard for DoD Facilities</p> <p>Derived from the ADA and ABA Accessibility Guidelines: Specifically includes: ABA Chapters 1 and 2 and Chapters 3 through 10.</p> <p>Use this reference in lieu of IBC Chapter 11.</p> <p>Excluded are:</p> <p>(a) Facilities, or portions of facilities, on a military installation that are designed and constructed for use exclusively by able-bodied military personnel (See Paragraph 3 for any reference to this exclusion).</p> <p>(b) Reserve and National Guard facilities, or portions of such facilities, owned by or under the control of the Department of Defense, that are designed and constructed for use exclusively by able-bodied military personnel. (See paragraph 3 for any reference to this exclusion).</p>
<b>U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES</b>	
	FDA National Food Code
<b>U.S. GREEN BUILDING COUNCIL (USGBC)</b>	
LEED-NC	Green Building Rating System for New Construction & Major Renovations
	Application Guide for Multiple Buildings and On-Campus Building Projects

#### 4.2. MILITARY CRITERIA

The project shall conform to the following criteria. Certain design impacts and features due to these criteria are noted for the benefit of the offeror. However, all requirements of the referenced criteria will be applicable, whether noted or not, unless otherwise specified herein.

4.2.1. Energy Policy Act of 2005 (Public Law 109-58) (applies only to the extent specifically implemented in the contract, which may or may not directly cite or reference EPACT)

#### 4.2.2. Executive Order 12770: Metric Usage In Federal Government

(a) Metric design and construction is required except when it increases construction cost. Offeror to determine most cost efficient system of measurement to be used for the project.

#### 4.2.3. TB MED 530: Occupational and Environmental Health Food Sanitation

4.2.4. Unified Facilities Criteria (UFC) 3-410-01FA: Heating, Ventilating, and Air Conditioning - applicable only to the extent specified in paragraph 5, herein.

4.2.5. Deleted.

4.2.6. UFC 3-600-01 Design: Fire Protection Engineering for Facilities. Use the latest edition of the IBC in coordination with this UFC. Use Chapters 3, 6, 7, 33 and UFC 3-600-01. If any conflict occurs between these Chapters and UFC 3-600-01, the requirements of UFC 3-600-01 take precedence. Use UFC 3-600-01 in lieu of IBC Chapters 4, 8,9,10.

#### 4.2.7. UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings

4.2.8. UFC 4-023-03 Design of Buildings to Resist Progressive Collapse (Use most recent version, regardless of references thereto in other publications)

(a) Note the option to use tie force method or alternate path design for Occupancy Category II.

#### 4.2.9. UFC 4-021-01 Design and O&M: Mass Notification Systems

#### 4.2.10. Technical Criteria for Installation Information Infrastructure Architecture (I3A)

(a) Email: [DetrickISECI3Aguide@conus.army.mil](mailto:DetrickISECI3Aguide@conus.army.mil)

4.2.11. U.S. Army Information Systems Engineering Command (USAISEC) SECRET Internet Protocol (IP) Router Network (SIPRNET) Technical Implementation Criteria (STIC).. See Paragraph 3 for applicability to specific facility type. May not apply to every facility. This is mandatory criteria for those facilities with SIPRNET.

4.2.11.1. Draft Guide Specification for Section 27 05 28 PROTECTIVE DISTRIBUTION SYSTEM (PDS) FOR SIPRNET COMMUNICATIONS SYSTEMS, found at [http://mrsi.usace.army.mil/rfp/Shared%20Documents/SECTION\\_270528-v3.pdf](http://mrsi.usace.army.mil/rfp/Shared%20Documents/SECTION_270528-v3.pdf)

## 5.0 GENERAL TECHNICAL REQUIREMENTS

This paragraph contains technical requirements with general applicability to Army facilities. See also Paragraph 3 for facility type-specific operational, functional and technical requirements. Residential or similar grade finishes and materials are not acceptable for inclusion in these buildings, unless otherwise specifically allowed.

### 5.1. SITE PLANNING AND DESIGN

5.1.1. STANDARDS AND CODES: The site planning and design shall conform to APPLICABLE CRITERIA and to paragraph 6, PROJECT SPECIFIC REQUIREMENTS.

5.1.2. SITE PLANNING OBJECTIVES: Group buildings in configurations that create a sense of community and promote pedestrian use. See paragraph 3 for additional site planning requirements relating to building functions.

5.1.2.1. Provide enclosures and or visual screening devices for Outdoor Utility such as dumpsters, emergency generators, transformers, heating, ventilation, and air conditioning units from streetscape and courtyard views to limit visual impact. Enclosures shall be compatible with the building they serve and accessible by vehicle. The location of dumpsters can have a significant visual impact and should be addressed as part of an overall building design and incorporated in site planning.

5.1.2.2. Where included in the project, dumpster pads shall be concrete (minimum of 8 inches thick on 4 inch base course, unless site conditions dictate more conservative requirements) and directly accessible by way of a paved service drive or parking lot with adequate overhead clearance for collection vehicles. Provide space at dumpster areas for recycling receptacles. Coordinate with Installation on recycling receptacle types, sizes and access requirements and provide space at dumpster areas to accommodate them.

5.1.2.3. Vehicular Circulation. Apply design vehicle templates provided by the American Association of State Highway and Transportation Officials (AASHTO) to the site design. The passenger car class includes passenger cars and light trucks, such as vans and pick-ups. The passenger car template is equivalent to the non-organizational – privately owned vehicle (POV). The truck class template includes single-unit trucks, recreation vehicles, buses, truck tractor-semi-trailer combinations, and trucks or truck tractors with semi-trailers in combination with full trailers. Provide vehicle clearances required to meet traffic safety for emergency vehicles, service vehicles, and moving vans. Provide required traffic control signage Site entrances and site drive aisles shall maximize spacing between drives, incorporate right-angle turns, and limit points of conflict between traffic. Design Services Drives to restrict access to unauthorized vehicles by removable bollards, gates, or other barriers to meet Anti-Terrorism/Force Protection (ATFP) requirements. Orient service drives to building entrances other than the primary pedestrian entry at the front of the building.

5.1.2.4. Provide Emergency Vehicle Access around the facility and shall be in accordance with AT/FP requirements. Maintain a 33-foot clear zone buffer for emergency vehicles, designed to prevent other vehicles from entering the AT/FP standoff to the building.

5.1.2.5. Clear and grub all trees and vegetation necessary for construction; but, save as many trees as possible. Protect trees to be saved during the construction process from equipment.

5.1.2.6. Stormwater Management. Employ design and construction strategies (Best Management Practices) that reduce stormwater runoff, reduce discharges of polluted water offsite and maintain or restore predevelopment hydrology with respect to temperature, rate, volume and duration of flow to the maximum extent practicable. See paragraph 6, PROJECT SPECIFIC requirements for additional information.

5.1.3. EXTERIOR SIGNAGE: Provide exterior signage in accordance with Appendix H, Exterior Signage. Provide exterior NO SMOKING signage that conveys building and grounds smoking policy.

5.1.4. EXISTING UTILITIES: Base utilities maps and capacities for this site are included as part of this RFP. See paragraph 6 for more detailed information.

## 5.2. SITE ENGINEERING

5.2.1. STANDARDS AND CODES: The site engineering shall conform to APPLICABLE CRITERIA.

### 5.2.2. SOILS:

5.2.2.1. A report has been prepared to characterize the subsurface conditions at the project site and is **appended to these specifications**. The report provides a general overview of the soil and geologic conditions with detailed descriptions at discrete boring locations. The Contractor's team shall include a licensed geotechnical engineer to interpret the report and develop earthwork and foundation recommendations and design parameters in which to base the contractor's design. If any additional subsurface investigation or laboratory analysis is required to better characterize the site or develop the final design, the Contractor shall perform it under the direction of a licensed geotechnical engineer. There will be no separate payment for the cost of additional tests. If differences between the Contractor's additional subsurface investigation and the government provided soils report or the reasonably expected conditions require material revisions in the design, an equitable adjustment may be made, in accordance with the provisions of the Differing Site Conditions clause. The basis for the adjustment would be the design and construction appropriate for the conditions described in the Government furnished report or the reasonably expected conditions, in comparison with any changes required by material differences in the actual conditions encountered, in accordance with the terms of contract clause Differing Site Conditions.

5.2.2.2. The contractor's licensed geotechnical engineer shall prepare a final geotechnical evaluation report, to be submitted along with the first foundation design submittal, as described in Section 01 33 16, *Design After Award*.

### 5.2.3. VEHICLE PAVEMENTS: (as applicable to the project)

5.2.3.1. Design procedures and materials shall conform to one of the following: 1) the USACE Pavement Transportation Computer Assisted Structural Engineering (PCASE) program, 2) American Association of State Highway and Transportation Officials (AASHTO) or, 3) the applicable state Department of Transportation standards in which the project is located. See paragraph 5.2.2.2 and Section 01 33 16 for required information for the Contractor's geotechnical evaluation report. The minimum flexible pavement section shall consist of 2 inches of asphalt and 6 inches of base or as required by the pavement design, whichever is greater, unless specifically identified by the Government to be a gravel road. Design roads and parking areas for a life expectancy of 25 years with normal maintenance. Parking area for tactical vehicles (as applicable to the project) shall be Portland Cement Concrete (PCC) rigid pavement design. For concrete pavements, submit joint layout plan for review and concurrence. Design pavements for military tracked vehicles (as applicable to the project) IAW USACE PCASE. Traffic estimates for each roadway area will be as shown on the drawings or listed in Section 01 10 00 Paragraph 6.4.4. Pavement markings and traffic signage shall comply with the Installation requirements and with the Manual on Uniform Traffic Control Devices.

#### 5.2.3.2. Parking Requirements.

(a) All handicap POV parking lots (where applicable in the facility specific requirements) shall meet the ADA and ABA Accessibility Guidelines for accessible parking spaces.

(b) Design POV parking spaces for the type of vehicles anticipated, but shall be a minimum of 9 ft by 18 ft for POVs, except for two wheel vehicles.



5.2.3.3. Sidewalks. Design the network of walks throughout the complex (where applicable) to facilitate pedestrian traffic among facilities, and minimize the need to use vehicles. Incorporate sidewalks to enhance the appearance of the site development, while creating a sense of entry at the primary patron entrances to the buildings. Minimum sidewalk requirements are in Paragraph 3, where applicable and/or paragraph 6 and/or site plans, where applicable..

5.2.4. CATHODIC PROTECTION: Provide cathodic protection systems for all underground metallic systems and metallic fittings/portions of non-metallic, underground systems, both inside and outside the building 5 foot line that are subject to corrosion. Coordinate final solutions with the installation to insure an approach that is consistent with installation cathodic protection programs.

5.2.5. UTILITIES: See paragraph 6.4.6 for specific information on ownership of utilities and utility requirements. Meter all utilities (gas, water, and electric, as applicable) to each facility. For Government owned utilities, install meters that are wireless data transmission capable as well as have a continuous manual reading option. All meters will be capable of at least hourly data logging and transmission and provide consumption data for gas, water, and electricity. Gas and electric meters will also provide demand readings based on consumption over a maximum of any 15 minute period. Configure all meters to transmit at least daily even if no receiver for the data is currently available at the time of project acceptance. For privatized utilities, coordinate with the privatization utility(ies) for the proper meter base and meter installation.

5.2.6. PERMITS: The CONTRACTOR shall be responsible for obtaining all permits (local, state and federal) required for design and construction of all site features and utilities.

5.2.7. IRRIGATION. Landscape irrigation systems, if provided, shall comply with the following:

5.2.7.1. Irrigation Potable Water Use Reduction. Reduce irrigation potable water use by 100 percent using LEED credit WE1.1 baseline (no potable water used for irrigation), except where precluded by other project requirements.

5.2.8. EPA WATERSENSE PRODUCTS AND CONTRACTORS. Except where precluded by other project requirements, use EPA WaterSense labeled products and irrigation contractors that are certified through a WaterSense labeled program where available.

### 5.3. ARCHITECTURE AND INTERIOR DESIGN:

This element will be evaluated per APPLICABLE CRITERIA under the quality focus.

5.3.1. STANDARDS AND CODES: The architecture and interior design shall conform to APPLICABLE CRITERIA.

5.3.2. GENERAL: Overall architectural goal is to provide a functional, quality, visually appealing facility that is a source of pride for the installation and delivered within the available budget and schedule.

5.3.3. COMPUTATION OF AREAS: See APPENDIX Q for how to compute gross and net areas of the facility(ies).

5.3.4. BUILDING EXTERIOR: Design buildings to enhance or compliment the visual environment of the Installation. Where appropriate, reflect a human scale to the facility. Building entrance should be architecturally defined and easily seen. When practical, exterior materials, roof forms, and detailing shall be compatible with the surrounding development and adjacent buildings on the Installation and follow locally established architectural themes. Use durable materials that are easy to maintain. Exterior colors shall conform to the Installation requirements. See paragraph 6.

5.3.4.1. Building Numbers: Permanently attach exterior signage on two faces of each building indicating the assigned building number or address. Building number signage details and locations shall conform to Appendix H, Exterior Signage.

### 5.3.5. BUILDING INTERIOR

5.3.5.1. Space Configuration: Arrange spaces in an efficient and functional manner in accordance with area adjacency matrices.

5.3.5.2. Surfaces: Appearance retention is the top priority for building and furniture related finishes. Provide low maintenance, easily cleaned room finishes that are commercially standard for the facility occupancy specified, unless noted otherwise.

5.3.5.3. Color: The color, texture and pattern selections for the finishes of the building shall provide an aesthetically pleasing, comfortable, easily maintainable and functional environment for the occupants. Coordinate the building colors and finishes for a cohesive design. Select colors appropriate for the building type. Use color, texture and pattern to path or way find through the building. Trendy colors that will become dated shall be limited to non-permanent finishes such as carpet and paint. Select finishes with regards to aesthetics, maintenance, durability, life safety and image. Limit the number of similar colors for each material. Use medium range colors for ceramic and porcelain tile grout to help hide soiling. Plastic laminate and solid surface materials shall have patterns that are mottled, flecked or speckled. Coordinate finish colors of fire extinguisher cabinets, receptacle bodies and plates, fire alarms / warning lights, emergency lighting, and other miscellaneous items with the building interior. Match color of equipment items on ceilings (speakers, smoke detectors, grills, etc.) the ceiling color.

5.3.5.4. Circulation: Circulation schemes must support easy way finding within the building.

5.3.5.5. Signage: Provide interior signage for overall way finding and life safety requirements. A comprehensive interior plan shall be from one manufacturer. Include the following sign types: (1) Lobby Directory, (2) Directional Signs; (3) Room Identification Signs; (4) Building Service Signs; (5) Regulatory Signs; (6) Official and Unofficial Signs (7) Visual Communication Boards (8) NO SMOKING signage that conveys building smoking policy. Use of emblems or logos may also be incorporated into the signage plan.

5.3.5.6. Window Treatment: Provide interior window treatments with adjustable control in all exterior window locations for control of day light coming in windows or privacy at night. Maintain uniformity of treatment color and material to the maximum extent possible within a building.

5.3.5.7. Casework: Unless, otherwise specified, all casework for Cabinetry and cases shall be "custom grade", as described in the AWI Quality Standards.

### 5.3.6. COMPREHENSIVE INTERIOR DESIGN

5.3.6.1. Comprehensive Interior Design includes the integration of a Structural Interior Design (SID) and a Furniture, Fixtures and Equipment (FF&E) design and package. SID requires the design, selection and coordination of interior finish materials that are integral to or attached to the building structure. Completion of a SID involves the selection and specification of applied finishes for the building's interior features including, but not limited to, walls, floors, ceilings, trims, doors, windows, window treatments, built-in furnishings and installed equipment, lighting, and signage. The SID package includes finish schedules, finish samples and any supporting interior elevations, details or plans necessary to communicate the building finish design and build out. The SID also provides basic space planning for the anticipated FF&E requirements in conjunction with the functional layout of the building and design issues such as life safety, privacy, acoustics, lighting, ventilation, and accessibility. See Section 01 33 16 for SID design procedures.

5.3.6.2. The FF&E design and package includes the design, selection, color coordination and of the required furnishing items necessary to meet the functional, operational, sustainability, and aesthetic needs of the facility coordinated with the interior finish materials in the SID. The FF&E package includes the specification, procurement documentation, placement plans, ordering and finish information on all freestanding furnishings and accessories, and a cost estimate. Coordinate the selection of furniture style, function and configuration with the defined requirements. Examples of FF&E items include, but are not limited to workstations, seating, files, tables, beds, wardrobes, draperies and accessories as well as marker boards, tack boards, and presentation screens. Criteria for furniture selection include function and ergonomics, maintenance, durability, sustainability, comfort and cost. See Section 01 33 16 for FFE design procedures.

#### 5.4. STRUCTURAL DESIGN

5.4.1. STANDARDS AND CODES: The structural design shall conform to APPLICABLE CRITERIA.

5.4.2. GENERAL: The structural system must be compatible with the intended functions and components that allows for future flexibility and reconfigurations of the interior space. Do not locate columns, for instance, in rooms requiring visibility, circulation or open space, including, but not limited to entries, hallways, common areas, classrooms, etc. Select an economical structural system based upon facility size, projected load requirements and local availability of materials and labor. Base the structural design on accurate, site specific geotechnical information and anticipated loads for the building types and geographical location. Consider climate conditions, high humidity, industrial atmosphere, saltwater exposure, or other adverse conditions when selecting the type of cement and admixtures used in concrete, the concrete cover on reinforcing steel, the coatings on structural members, expansion joints, the level of corrosion protection, and the structural systems. Analyze, design and detail each building as a complete structural system. Design structural elements to preclude damage to finishes, partitions and other frangible, non-structural elements to prevent impaired operability of moveable components; and to prevent cladding leakage and roof ponding. Limit deflections of structural members to the allowable of the applicable material standard, e.g., ACI, AISC, Brick Industry Association, etc. When modular units or other pre-fabricated construction is used or combined with stick-built construction, fully coordinate and integrate the overall structural design between the two different or interfacing construction types. If the state that the project is located in requires separate, specific licensing for structural engineers (for instance, such as in Florida, California and others), then the structural engineer designer of record must be registered in that state.

5.4.3. LOADS: See paragraph 3 for facility specific (if applicable) and paragraph 6 for site and project specific structural loading criteria. Unless otherwise specified in paragraph 6, use Exposure Category C for wind. If not specified, use Category C unless the Designer of Record can satisfactorily justify another Exposure Category in its design analysis based on the facility Master Plan. Submit such exceptions for approval as early as possible and prior to the Interim Design Submittal in Section "Design After Award". Design the ancillary building items, e.g. doors, window jambs and connections, overhead architectural features, systems and equipment bracing, ducting, piping, etc. for gravity, seismic, lateral loads and for the requirements of UFC 4-010-01, DOD Minimum Antiterrorism Standards for Buildings. Ensure and document that the design of glazed items includes, but is not limited to, the following items under the design loads prescribed in UFC 4-010-01:

- (a) Supporting members of glazed elements, e.g. window jamb, sill, header
- (b) Connections of glazed element to supporting members, e.g. window to header
- (c) Connections of supporting members to each other, e.g. header to jamb
- (d) Connections of supporting members to structural system, e.g. jamb to foundation.

5.4.4. TERMITE TREATMENT: (Except Alaska) Provide termite prevention treatment in accordance with Installation and local building code requirements, using licensed chemicals and licensed applicator firm.

## 5.5. THERMAL PERFORMANCE

5.5.1. STANDARDS AND CODES: Building construction and thermal insulation for mechanical systems shall conform to APPLICABLE CRITERIA.

5.5.2. BUILDING ENVELOPE SEALING PERFORMANCE REQUIREMENT. Design and construct the building envelope for office buildings, office portions of mixed office and open space (e.g., company operations facilities), dining, barracks and instructional/training facilities with a continuous air barrier to control air leakage into, or out of, the conditioned space. Clearly identify all air barrier components of each envelope assembly on construction documents and detail the joints, interconnections and penetrations of the air barrier components. Clearly identify the boundary limits of the building air barriers, and of the zone or zones to be tested for building air tightness on the drawings. The use of painted interior walls is not an acceptable air barrier method.

5.5.2.1. Trace a continuous plane of air-tightness throughout the building envelope and make flexible and seal all moving joints.

5.5.2.2. The air barrier material(s) must have an air permeance not to exceed 0.004 cfm / sf at 0.3" wg (0.02 L/s.m<sup>2</sup> @ 75 Pa) when tested in accordance with ASTM E 2178

5.5.2.3. Join and seal the air barrier material of each assembly in a flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of these assemblies and components.

5.5.2.4. Support the air barrier so as to withstand the maximum positive and negative air pressure to be placed on the building without displacement, or damage, and transfer the load to the structure.

5.5.2.5. Seal all penetrations of the air barrier. If any unavoidable penetrations of the air barrier by electrical boxes, plumbing fixture boxes, and other assemblies are not airtight, make them airtight by sealing the assembly and the interface between the assembly and the air barrier or by extending the air barrier over the assembly.

5.5.2.6. The air barrier must be durable to last the anticipated service life of the assembly.

5.5.2.7. Do not install lighting fixtures with ventilation holes through the air barrier

5.5.2.8. Provide a motorized damper in the closed position and connected to the fire alarm system to open on call and fail in the open position for any fixed open louvers at elevator shafts. Coordinate the motorized elevator hoistway vent damper(s) with the Fire Protection System design in paragraph 5.10. Ensure that the damper(s) is accessible to facilitate regular inspection and maintenance.

5.5.2.9. Damper and control to close all ventilation or make-up air intakes and exhausts, , etc., when leakage can occur during inactive periods. Atrium smoke exhaust and intakes shall only open when activated per IBC and other applicable Fire Code requirements.

5.5.2.10. If garages under buildings are applicable, compartmentalize garages by providing air-tight vestibules at building access points.

5.5.2.11. Compartmentalize spaces under negative pressure such as boiler rooms and provide make-up air for combustion.

5.5.2.12. Performance Criteria and Substantiation: Submit the qualifications and experience of the testing entity for approval. Demonstrate performance of the continuous air barrier for the opaque building envelope by the following tests:

- (a) Develop an Air Barrier Quality Control plan to assure that a competent air barrier inspector/specialist inspects the critical components prior to them being concealed. At a minimum, three onsite inspections are required during construction to assure the completeness of the construction and design.
- (b) Test the completed building and demonstrate that the air leakage rate of the building envelope does not exceed 0.25cfm/ft<sup>2</sup> at a pressure differential of 0.3" w.g.(75 Pa) in accordance with ASTM's E 779 (2003) or E-1827-96 (2002). Accomplish tests using both pressurization and depressurization.. Divide the volume of air leakage in cfm @ 0.3" w.g. (L/s @ 75 Pa) by the area of the pressure boundary of the building, including roof or ceiling, walls and floor to produce the air leakage rate in cfm/ft<sup>2</sup> @ 0.3" w.g. (L/s.m<sup>2</sup> @ 75 Pa). Do not test the building until verifying that the continuous air barrier is in place and installed without failures in accordance with installation instructions so that repairs to the continuous air barrier, if needed to comply with the required air leakage rate, can be done in a timely manner.
- (c) Test the completed building using Infrared Thermography testing. Use infrared cameras with a resolution of 0.1deg C or better. Perform testing on the building envelope in accordance with ISO 6781:1983 and ASTM C1060-90(1997). Determine air leakage pathways using ASTM E 1186-03 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems, and perform corrective work as necessary to achieve the whole building air leakage rate specified in (a) above.
- (d) Notify the Government at least three working days prior to the tests to provide the Government the opportunity to witness the tests. Provide the Government written test results confirming the results of all tests.

## 5.6. PLUMBING

5.6.1. STANDARDS AND CODES: The plumbing system shall conform to APPLICABLE CRITERIA.

5.6.2. PRECAUTIONS FOR EXPANSIVE SOILS: Where expansive soils are present, include design features for underslab piping systems and underground piping serving chillers, cooling towers, etc, to control forces resulting from soil heave. Some possible solutions include, but are not necessarily limited to, features such as flexible expansion joints, slip joints, horizontal offsets with ball joints, or multiple bell and spigot gasketed fittings. For structurally supported slabs, suspend piping from the structure with adequate space provided below the pipe for the anticipated soil movement.

5.6.3. HOT WATER SYSTEMS: For Hot Water heating and supply, provide a minimum temp of 140 Deg F in the storage tank and a maximum of 110 Deg F at the fixture, unless specific appliances or equipment specifically require higher temperature water supply.

5.6.4. SIZING HOT WATER SYSTEMS: Unless otherwise specified or directed in paragraph 3, design in accordance with ASHRAE Handbook Series (appropriate Chapters), ASHRAE Standard 90.1, and the energy conservation requirements of the contract. Size and place equipment so that it is easily accessible and removable for repair or replacement.

5.6.5. JANITOR CLOSETS: In janitor spaces/room/closets, provide at minimum, a service sink with heavy duty shelf and wall hung mop and broom rack(s).

5.6.6. FLOOR DRAINS: As a minimum, provide floor drains in mechanical rooms and areas, janitor spaces/rooms/closets and any other area that requires drainage from fixtures or equipment, drain downs, condensate, as necessary.

5.6.7. URINALS: Urinals shall be non-water type, conforming to ASHRAE Standard 189.1. Non-Water type shall include sealed replaceable cartridge or integral liquid seal trap. Either non-water type urinal shall use a biodegradable liquid to provide the seal and maintain a sanitary and odor-free environment. Install, test and maintain in accordance with manufacturer's recommendations. Slope the sanitary sewer branch line for non-water use urinals a minimum of 1/4 inch per foot. Do not use copper tube or pipe for

drain lines that connect to the urinal. Manufacturer shall provide an operating manual and on-site training to installation operations personnel for the proper care and maintenance of the urinal. Do not provide non-water type urinals for barracks type or other living spaces. Those fixtures shall be water-use type, conforming to ASHRAE 189.1 (0.5 gpf/1.9 lpf).

5.6.8. **BUILDING WATER USE REDUCTION.** Reduce building potable water use in each building 30 percent from the Baseline, using the Manufacturing Performance Requirements for Plumbing Fixtures from the Energy Policy Act of 1992 (Public Law 102-486), except as modified by LEED. See Appendix S. Public lavatory faucets shall deliver a maximum flow rate of 0.5 gallons per minute, when tested in accordance with ASME A 112.18/CSA B125 and use that flowrate as the Baseline figure for calculating the 30 percent reduction requirement from the Baseline.

5.6.9. Do not use engineered vent or Sovent® type drainage systems.

5.6.10. Where the seasonal design temperature of the cold water entering a building is below the seasonal design dew point of the indoor ambient air, and where condensate drip will cause damage or create a hazard, insulate plumbing piping with a vapor barrier type of insulation to prevent condensation. Do not locate water or drainage piping over electrical wiring or equipment unless adequate protection against water (including condensation) damage is provided. Insulation alone is not adequate protection against condensation. Follow ASHRAE Fundamentals Chapter 23, Insulation for Mechanical Systems, IMC paragraph 1107 and International Energy Conservation Code for pipe insulation requirements.

5.6.11. Cover all drain, waste and vent piping to prevent mortar or other debris from being flushed down and blocking pipes during such construction activities.

## 5.7. ELECTRICAL AND TELECOMMUNICATIONS SYSTEMS

5.7.1. **STANDARDS AND CODES:** The electrical systems for all facilities shall conform to APPLICABLE CRITERIA.

5.7.2. **MATERIALS AND EQUIPMENT:** Materials, equipment and devices shall, as a minimum, meet the requirements of Underwriters Laboratories (UL) where UL standards are established for those items. Wiring for branch circuits shall be copper. Motors larger than one-half horsepower shall be three phase. All electrical systems shall be pre-wired and fully operational unless otherwise indicated. Wall mounted electrical devices (power receptacles, communication outlets and CATV outlets) shall have matching colors, mounting heights and faceplates.

5.7.3. **POWER SERVICE:** Primary service from the base electrical distribution system to the pad-mounted transformer and secondary service from the transformer to the building service electrical equipment room shall be underground. See paragraph 6 for additional site electrical requirements.

5.7.3.1. **Spare Capacity:** Provide 10% space for future circuit breakers in all panelboards serving residential areas of buildings and 15% spaces in all other panelboards.

5.7.4. **TELECOMMUNICATION SERVICE:** Connect the project's facilities to the Installation telecommunications (voice and data) system through the outside plant (OSP) telecommunications underground infrastructure cabling system per the I3A Criteria. Connect to the OSP cabling system from each facility main cross connect located in the telecommunications room.

5.7.5. **LIGHTING:** Comply with the recommendations of the Illumination Engineering Society of North America (IESNA), the National Energy Policy Act and Energy Star requirements for lighting products..

### 5.7.5.1. Interior Lighting:

(a) **Reflective Surfaces:** Coordinate interior architectural space surfaces and colors with the lighting systems to provide the most energy-efficient workable combinations.

(b) High Efficiency Fluorescent Lighting: Utilize NEMA premium electronic ballasts and energy efficient fluorescent lamps with a Correlated Color Temperature (CCT) of 4100K. Linear fluorescent and compact fluorescent fixtures shall have a Color Rendering Index of (CRI) of 87 or higher. Fluorescent lamps shall be the low mercury type qualifying as non-hazardous waste upon disposal. Do not use surface mounted fixtures on acoustical tile ceilings. Provide an un-switched fixture with emergency ballast at each entrance to the building.

(c) Solid State Lighting: Fixtures shall provide lighting with a minimum Correlated Color Temperature (CCT) of 4100K and shall have a Color Rendering Index of (CRI) of 75 or higher. Verify performance of the light producing solid state components by a test report in compliance with the requirements of IESNA LM 80. Verify performance of the solid state light fixtures by a test report in compliance with the requirements of IESNA LM 79. Provide lab results by a NVLAP certified laboratory. The light producing solid state components and drivers shall have a life expectancy of 50,000 operating hours while maintaining at least 70% of original illumination level. Provide a complete five year warranty for fixtures.

(d) Metal Halide Lighting (where applicable): Metal Halide lamp fixtures in the range of 150-500 Watts shall be pulse start type and have a minimum efficiency rating of 88%.

(e) Lighting Controls: ANSI/ASHRAE/IESNA 90.1 has specific lighting controls requirements. See Also Appendix T, Functional Area Lighting Control Strategy.

(f) Exterior Lighting: See paragraph 6.9 for site specific information, if any, on exterior lighting systems. Minimize light pollution and light trespass by not over lighting and use cut-off type exterior luminaries.

5.7.6. TELECOMMUNICATION SYSTEM: Building telecommunications cabling systems (BCS) and OSP telecommunications cabling system shall conform to APPLICABLE CRITERIA, including but not limited to I3A Technical Criteria. An acceptable BCS encompasses, but is not limited to, copper and fiber optic (FO) entrance cable, termination equipment, copper and fiber backbone cable, copper and fiber horizontal distribution cable, workstation outlets, racks, cable management, patch panels, cable tray, cable ladder, conduits, grounding, and labeling.. Items included under OSP infrastructure encompass, but are not limited to, manhole and duct infrastructure, copper cable, fiber optic cable, cross connects, terminations, cable vaults, and copper and FO entrance cable.

5.7.6.1. Design, install, label and test all telecommunications systems in accordance with the I3A Criteria and ANSI/TIA/EIA 568, 569, and 606 standards. A Building Industry Consulting Services International (BICSI) Registered Communications Distribution Designer (RCDD) with at least 2 yrs related experience shall develop and stamp telecommunications design, and prepare the test plan. See paragraph 5.8.2.5 for design of environmental systems for Telecommunications Rooms.

5.7.6.2. The installers assigned to the installation of the telecommunications system or any of its components shall be regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. Key personnel; i.e., supervisors and lead installers assigned to the installation of this system or any of its components shall be BICSI Registered Cabling Installers, Technician Level. Submit documentation of current BICSI certification for each of the key personnel. In lieu of BICSI certification, supervisors and installers shall have a minimum of 5 years experience in the installation of the specified copper and fiber optic cable and components. They shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products.

5.7.6.3. Perform a comprehensive end to end test of all circuits to include all copper and fiber optic cables upon completion of the BCS and prior to acceptance of the facility. Provide adequate advanced notification to the COR to allow COR and Installation personnel attendance. The BCS circuits include but are not limited to all copper and fiber optic(FO) entrance cables, termination equipment, copper and fiber backbone cable, copper and fiber horizontal distribution cable, and workstation outlets. Test in accordance with ANSI/EIA/TIA 568 standards. Use test instrumentation that meets or exceeds the standard. Submit the official test report to include test procedures, parameters tested, values, discrepancies and corrective actions in electronic format. Test and accomplish all necessary corrective

actions to ensure that the government receives a fully operational, standards based, code compliant telecommunications system.

5.7.7. LIGHTNING PROTECTION SYSTEM: Provide a lightning protection system where recommended by the Lightning Risk Assessment of NFPA 780, Annex L.

#### 5.8. HEATING, VENTILATING, AND AIR CONDITIONING

5.8.1. STANDARDS AND CODES: The HVAC system shall conform to APPLICABLE CRITERIA.

#### 5.8.2. DESIGN CONDITIONS.

5.8.2.1. Outdoor and indoor design conditions shall be in accordance with UFC 3-410-01FA. Outdoor air and exhaust ventilation requirements for indoor air quality shall be in accordance with ASHRAE 62.1. All Buildings with minimum LEED Silver requirement (or better) will earn LEED Credit EQ 7.1, Thermal Comfort-Design., except where precluded by other project requirements. Where the contract specifies indoor design temperature, airflow, humidity conditions, etc., use those parameters.

5.8.2.2. High Humidity Areas: Design HVAC systems in geographical areas meeting the definition for high humidity in UFC 3-410-01FA to comply with the special criteria therein for humid areas.

5.8.2.3. Cooling equipment may be oversized by up to 15 percent to account for recovery from night setback. Heating equipment may be oversized by up to 30 percent to account for recovery from night setback. Design single zone systems and multi-zone systems to maintain an indoor design condition of 50% relative humidity for cooling only. For heating only where the indoor relative humidity is expected to fall below 20% for extended periods, add humidification to increase the indoor relative humidity to 30%. Provide ventilation air from a separate dedicated air handling unit (DOAU) for facilities using multiple single zone fan-coil type HVAC systems. Do not condition outside air through fan coil units. In Air handlers that handle outdoor air and have fans that run continuously during the occupied mode, direct expansion cooling coils may be used only if the controls and compressor technology is provided that allows the compressor to operate down to 10% of full load without utilizing hot gas bypass to minimize the potential of delivering unconditioned outdoor air to the space.

5.8.2.4. Locate all equipment so that service, adjustment and replacement of controls or internal components are readily accessible for easy maintenance.

5.8.2.5. Environmental Requirements for Telecommunications Rooms and Telecommunications Equipment Rooms, (including SIPRNET ROOMS, where applicable for specific facility type). Comply with ANSI/EIA/TIA 569 (including applicable Addenda). Maintain environmental conditions at the Class 1 and 2 Recommended Operating Environment. Before being introduced into the room, filter and pre-condition outside air to remove particles with the minimum MERV filtration quality shown in the ASHRAE HVAC Applications, Chapter 17. Maintain rooms under positive pressure relative to surrounding spaces. Design computer room air conditioning units specifically for telecommunications room applications. Build and test units in accordance with the requirements of ANSI/ASHRAE Standard 127. A complete air handling system shall provide ventilation, air filtration, cooling and dehumidification, humidification (as determined during the design phase), and heating. The system shall be independent of other facility HVAC systems and shall be required year round.

5.8.2.6. Fire dampers: dynamic type with a dynamic rating suitable for the maximum air velocity and pressure differential to which the damper is subjected. Test each fire damper with the air handling and distribution system running.

5.8.3. BUILDING AUTOMATION SYSTEM. The Building Automation System (BAS) shall be a single complete non-proprietary Direct Digital Control (DDC) system for control of all heating, ventilating and air conditioning (HVAC) systems and for control of other building systems. The BAS shall be based on an



Open implementation of BACnet using ASHRAE 135 exclusively as the communications protocol for communication between DDC Hardware devices to allow multi-vendor interoperability.

5.8.3.1. The system shall be Open in that it is designed and installed such that the Government or its agents are able to perform repair, replacement, upgrades, and expansions of the system without further dependence on the original hardware vendor or their agents. This includes, but is not limited to the following:

- Hardware shall be installed such that individual control equipment can be replaced by similar control equipment from other equipment manufacturers with no loss of system functionality.
- Necessary documentation (including rights to documentation and data), configuration information, configuration tools, application programs (with comments explaining program logic), application source code for programmable controllers, drivers, and other software shall be licensed to and remain with the Government such that the Government or its agents are able to perform repair, replacement, upgrades, and expansions of the system without subsequent or future dependence on the Contractor.

5.8.3.2. All DDC Hardware shall:

- Be connected to a ASHRAE 135 MS/TP control network.
- Implement all required functionality of the application network interface via BACnet objects, properties, and services
- Shall conform to basewide addressing schemes, particularly with regard to Device ID.
- Minimize the use of proprietary BACnet objects and properties
- Not use any of the following BACnet services for application control functionality or communication:
  - AtomicFile or AtomicFileWrite
  - ConfirmedTextMessage or UnconfirmedTextMessage
  - ConfirmedPrivateTransfer or UnconfirmedPrivateTransfer
- Communicate over the control network via ASHRAE 135 exclusively.
- Conform to the BACnet Testing Lab's Device Implementation Guidelines.
- Be capable of responding to Who-Is/I-Am and Who-Has/I-Have service requests.
- All settings and parameters used by the application shall be fully configurable:
  - to the greatest extent possible, via properties of BACnet objects that can be written to via BACnet services.
  - via properties of BACnet objects that can be written to via BACnet services for the following
- Setpoint
- Alarm limit
- Schedule modification
- Trend modification
  - All other settings and parameters that can not be written to via BACnet services shall be fully configurable via either:
- Properties of BACnet objects that can be written to with a configuration tool, or
- Hardware settings on the controller itself to support the application.
- Provide BACnet objects, properties, and services required to support the application and supervisory monitoring and control functionality including:
  - System start/stop and overrides.
  - Scheduling
  - Alarming
  - Trending
- To the greatest extent practical, not rely on the control network to perform the application
- Be BTL Listed
- Provide on board nonvolatile memory for devices accumulating energy consumption.

5.8.3.3. Include any device capable of communicating over IEEE 802.3 (Ethernet) in a DIACAP and Certificate of Networkiness (CoN) for this installation, regardless of whether the Ethernet connection is active at time of installation. Do not use devices with Ethernet connection capability not included in a DIACAP or without a DIACAP or without a CoN shall not be used.

5.8.3.4. Gateways may be used provided that each gateway communicates with and performs protocol translation for control hardware controlling one and only one package unit.

5.8.3.5. Not Used

5.8.3.6. Not Used

5.8.3.7. Not Used

5.8.3.8. Provide the following to the Government for review prior to acceptance of the system:

- The latest version of all software including source code for application software (for programmable controllers), software licenses, and user manuals required to program, configure and operate the system.
- Points Schedule drawing that shows every DDC Hardware device. The Points Schedule shall contain the following information as a minimum for each device:
  - Device ID and network address (MS/TP network and MAC address, or IP address).
  - Input and Output Objects including Name, Type, Description, and relevant supported or required Properties.
  - Hardware I/O, including Type (AI, AO, BI, BO) and Description.
  - Alarm information including alarm limits and BACnet device IDs, object IDs, and property information.
  - Supervisory control information including BACnet device IDs, object IDs, and properties for trending and overrides.
  - Objects and Properties needed for device configuration.
  - Device IDs and objects (where applicable) of remote devices and objects that communicate with the given Device (e.g. clients and servers for BACnet services used by the given device).
  - Example Points Schedules are available at: <https://eko.usace.army.mil/fa/besc/>
- Riser diagram of the network showing all network cabling and hardware. Label hardware with BACnet Device IDs, BACnet network addresses, network names, and locations.
- A consolidated list of all Device IDs.
- Control System Schematic diagram and Sequence of Operation for each controlled system.
- Operation and Maintenance Instructions including procedures for system start-up, operation and shut-down, a routine maintenance checklist, and a qualified service organization list.
- Quality Control (QC) checklist (below) completed by the Contractor's Chief Quality Control (QC) Representative

**Table 5-1: QC Checklist**

Instructions: Initial each item, sign and date verifying that the requirements have been met.		
#	Description	Initials
1	All DDC Hardware is installed on a MS/TP or IP local control bus IAW ASHRAE135 section 9 or Annex J.	
2	Communication between DDC Hardware is only via ASHRAE 135. PrivateTransfer, TextMessage, or AtomicFile services have not been used.	
3	All sequences are performed using DDC Hardware.	
4	All software has been licensed to the Government	
5	Final As-built Drawings accurately represent the final installed system.	
6	O&M Instructions have been completed and submitted.	
7	All DDC hardware connected or intended to be connected to the IP network is covered under a DIACAP and has a certificate of Networthiness	
By signing below I verify that all requirements of the contract, including but not limited to the above, been met.		
Signature: _____ Date: _____		

5.8.3.9. Perform a Performance Verification Test (PVT) under Government supervision prior to system acceptance. During the PVT, demonstrate that the system performs as specified, including but not limited to demonstrating that the system is Open and correctly performs the Sequences of Operation.

5.8.3.10. Provide a 1 year unconditional warranty on the installed system and on all service call work. The warranty shall include labor and material necessary to restore the equipment involved in the initial service call to a fully operable condition.

5.8.3.11. Provide training at the project site on the installed building system . Upon completion of this training each student, using appropriate documentation, should be able to start the system, operate the system, recover the system after a failure, perform routine maintenance and describe the specific hardware, architecture and operation of the system.

5.8.4. TESTING, ADJUSTING AND BALANCING. Test and balance air and hydronic systems, using a firm certified for testing and balancing by the Associated Air Balance Council (AABC), National Environmental Balancing Bureau (NEBB), or the Testing Adjusting, and Balancing Bureau (TABB). The prime contractor shall hire the TAB firm directly, not through a subcontractor. Perform TAB in accordance with the requirements of the standard under which the TAB Firm's qualifications are approved, i.e., AABC MN-1, NEBB TABES, or SMACNA HVACTAB unless otherwise specified herein. All recommendations and suggested practices contained in the TAB Standard shall be considered mandatory. Use the provisions of the TAB Standard, including checklists, report forms, etc., as nearly as practicable to satisfy the Contract requirements. Use the TAB Standard for all aspects of TAB, including qualifications for the TAB Firm and Specialist and calibration of TAB instruments. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the TAB Standard, adhere to the manufacturer's recommendations. All quality assurance provisions of the TAB Standard such as performance guarantees shall be part of this contract. For systems or system components not covered in the TAB Standard, the TAB Specialist shall develop TAB procedures. Where new procedures, requirements, etc., applicable to the Contract requirements have been published or adopted by the body responsible for the TAB Standard used (AABC, NEBB, or TABB), the requirements and recommendations contained in these procedures and requirements are mandatory.

5.8.5. COMMISSIONING: Commission all HVAC systems and equipment, including controls, and all systems requiring commissioning for LEED Enhanced commissioning, in accordance with ASHRAE Guideline 1.1, ASHRAE Guideline 0 and LEED. Do not use the sampling techniques discussed in

ASHRAE Guideline 1.1 and in ASHRAE Guideline 0. Commission 100% of the HVAC controls and equipment. Hire the Commissioning Authority (CxA), certified as a CxA by AABC, NEBB, or TABB, as described in Guideline 1.1. The CxA will be an independent subcontractor and not an employee of the Contractor nor an employee or subcontractor of any other subcontractor on this project, including the design professionals (i.e., the DOR or their firm(s)). The CxA will communicate and report directly to the Government in execution of commissioning activities. The Contracting Officer's Representative will act as the Owner's representative in performance of duties spelled out under OWNER in Annex F of ASHRAE Guideline 0. Because required CxA contractual relationship may not be acceptable to GBCI for LEED certification, the project cannot earn LEED Credit EA3 Enhanced Commissioning. However, still complete, maintain and provide copies of all necessary LEED documentation for Credit EA 3. This LEED Credit cannot be included to meet the required LEED rating for this project. Contractor may attempt this as an additional credit for GBCI certification but the Government will not accept it until GBCI accepts it.

## 5.9. ENERGY CONSERVATION

5.9.1. The building including the building envelope, HVAC systems, service water heating, power, and lighting systems shall meet the Mandatory Provisions and the Prescriptive Path requirements of ASHRAE 90.1. Substantiation requirements are defined in Section 01 33 16, Design After Award.

5.9.2. Design all building systems and elements to meet the minimum requirements of ANSI/ASHRAE/IESNA 90.1. Design the buildings, including the building envelope, HVAC systems, service water heating, power, and lighting systems to achieve an energy consumption that is at least 40% below the consumption of a baseline building meeting the minimum requirements of ANSI/ASHRAE/IESNA Standard 90.1. Energy calculation methodologies and substantiation requirements are defined in Section 01 33 16, Design After Award.

5.9.3. Purchase Energy Star products, except use FEMP designated products where FEMP is applicable to the type product. The term "Energy Star product" means a product that is rated for energy efficiency under an Energy Star program. The term "FEMP designated product" means a product that is designated under the Federal Energy Management Program of the Department of Energy as being among the highest 25 percent of equivalent products for energy efficiency. When selecting integral sized electric motors, choose NEMA PREMIUM type motors that conform to NEMA MG 1, minimum Class F insulation system. Motors with efficiencies lower than the NEMA PREMIUM standard may only be used in unique applications that require a high constant torque speed ratio (e.g., inverter duty or vector duty type motors that conform to NEMA MG 1, Part 30 or Part 31).

5.9.4. Solar Hot Water Heating. Provide at least 30% of the domestic hot water requirements through solar heating methodologies, unless the results of a Life Cycle Cost Analysis (LCCA) developed utilizing the Building Life Cycle Cost Program (BLCC) which demonstrates that the solar hot water system is not life cycle cost effective in comparison with other hot water heating systems. The type of system will be established during the contract or task order competition and award phase, including submission of an LCCA for government evaluation to justify non-selection of solar hot water heating. The LCCA uses a study period of 25 years and the Appendix K utility cost information. The LCCA shall include life cycle cost comparisons to a baseline system to provide domestic hot water without solar components, analyzing at least two different methodologies for providing solar hot water to compare against the baseline system.

5.9.5. Process Water Conservation. When potable water is used to improve a building's energy efficiency, employ lifecycle cost effective water conservation measures, except where precluded by other project requirements.

5.9.6. Renewable Energy Features. The Government's goal is to implement on-site renewable energy generation for Government use when lifecycle cost effective. See Paragraph 6, PROJECT SPECIFIC REQUIREMENTS for renewable energy requirements for this project.

## 5.10. FIRE PROTECTION

**5.10.1. STANDARDS AND CODES** Provide the fire protection system conforming to APPLICABLE CRITERIA.

5.10.2. Inspect and test all fire suppression equipment and systems, fire pumps, fire alarm and detection systems and mass notification systems in accordance with the applicable NFPA standards. The fire protection engineer of record shall witness final tests. The fire protection engineer of record shall certify that the equipment and systems are fully operational and meet the contract requirements. Two weeks prior to each final test, the contractor shall notify, in writing, the installation fire department and the installation public work representative of the test and invite them to witness the test.

5.10.3. Fire Extinguisher Cabinets: Provide fire extinguisher cabinets and locations for hanging portable fire extinguishers in accordance with NFPA 10 Standard for Portable Fire Extinguishers. The Government will furnish and install portable fire extinguishers, which are personal property, not real property installed equipment.

5.10.4. Fire alarm and detection system: Required fire alarm and detection systems shall be the addressable type. Fire alarm initiating devices, such as smoke detectors, heat detectors and manual pull stations shall be addressable. When the system is in alarm condition, the system shall annunciate the type and location of each alarm initiating device. Sprinkler water flow alarms shall be zoned by building and by floor. Supervisory alarm initiating devices, such as valve supervisory switches, fire pump running alarm, low-air pressure on dry sprinkler system, etc. shall be zoned by type and by room location.

5.10.5. Roof Access: Paragraph 2-9 of UFC 3-600-01 Fire Protection for Facilities will be modified in the next update to that UFC. Pending revision, comply with roof access and stairway requirements in accordance with the International Building Code. Where roof access is required by the IBC or other criteria, comply with UFC 4-010-01, Anti-Terrorist Force Protection, Standard 14. "Roof Access".

5.10.6. Fire Protection Engineer Qualifications: In accordance with UFC 3-600-01, FIRE PROTECTION ENGINEERING FOR FACILITIES, the fire protection engineer of record shall be a registered professional engineer (P.E.) who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveys (NCEES), or a registered P.E. in a related engineering discipline with a minimum of 5 years experience, dedicated to fire protection engineering that can be verified with documentation.

**5.11. SUSTAINABLE DESIGN**

5.11.1. STANDARDS AND CODES: Sustainable design shall conform to APPLICABLE CRITERIA. See paragraph 6, PROJECT-SPECIFIC REQUIREMENTS for which version of LEED applies to this project. The LEED-NC Application Guide for Multiple Buildings and On-Campus Building Projects (AGMBC) applies to all projects. Averaging may be used for LEED compliance as permitted by the AGMBC but is restricted to only those buildings included in this project. Each building must individually comply with the requirements of paragraphs ENERGY CONSERVATION and BUILDING WATER USE REDUCTION.

5.11.2. LEED RATING, REGISTRATION, VALIDATION AND CERTIFICATION: See Paragraph PROJECT-SPECIFIC REQUIREMENTS for project minimum LEED rating/achievement level, for facilities that are exempt from the minimum LEED rating, for LEED registration and LEED certification requirements and for other project-specific information and requirements.

5.11.2.1. Innovation and Design Credits. LEED Innovation and Design (ID) credits are acceptable only if they are supported by formal written approval by GBCI (either published in USGBC Innovation and Design Credit Catalog or accompanied by a formal ruling from GBCI). LEED ID credits that require any Owner actions or commitments are acceptable only when Owner commitment is indicated in paragraph PROJECT-SPECIFIC REQUIREMENTS or Appendix LEED Project Credit Guidance

5.11.3. OPTIMIZE ENERGY PERFORMANCE. : Project must earn, as a minimum, the points associated with compliance with paragraph ENERGY CONSERVATION. LEED documentation differs from documentation requirements for paragraph ENERGY CONSERVATION and both must be provided. For LEED-NC v2.2 projects you may substitute ASHRAE 90.1 2007 Appendix G in its entirety for ASHRAE 90.1 2004 in accordance with USGBC Credit Interpretation Ruling dated 4/23/2008.

5.11.4. COMMISSIONING. See paragraph 5.8.5 COMMISSIONING for commissioning requirements. USACE templates for the required Basis of Design document and Commissioning Plan documents are available at <http://en.sas.usace.army.mil> (click on USACE LEED Commissioning Plan Template) and may be used at Contractor's option.

5.11.5. DAYLIGHTING. Except where precluded by other project requirements, do the following in at least 75 percent of all spaces occupied for critical visual tasks: achieve a 2 percent glazing factor (calculated in accordance with LEED credit EQ8.1) OR earn LEED Daylighting credit, provide appropriate glare control and provide either automatic dimming controls or occupant-accessible manual lighting controls.

5.11.6. LOW-EMITTING MATERIALS. Except where precluded by other project requirements, use materials with low pollutant emissions, including but not limited to composite wood products, adhesives, sealants, interior paints and finishes, carpet systems and furnishings,

5.11.7. CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT. Except where precluded by other project requirements, earn LEED credit EQ 3.1 Construction IAQ Management Plan, During Construction and credit EQ 3.2 Construction IAQ Management Plan, Before Occupancy.

5.11.8. RECYCLED CONTENT. In addition to complying with section RECYCLED/RECOVERED MATERIALS, earn LEED credit MR4.1, Recycled Content, 10 percent except where precluded by other project requirements.

5.11.9. BIOBASED AND ENVIRONMENTALLY PREFERABLE PRODUCTS. Except where precluded by other project requirements, use materials with biobased content, materials with rapidly renewable content, FSC certified wood products and products that have a lesser or reduced effect on human health and the environment over their lifecycle to the maximum extent practicable.

5.11.10. FEDERAL BIOBASED PRODUCTS PREFERRED PROCUREMENT PROGRAM (FB4P). The Farm Security and Rural Investment Act (FSRIA) of 2002 required the U.S. Department of Agriculture (USDA) to create procurement preferences for biobased products that are applicable to all federal procurement (to designate products for biobased content). For all designated products that are used in this project, meet USDA biobased content rules for them except use of a designated product with USDA biobased content is not required if the biobased product (a) is not available within a reasonable time, (b) fails to meet performance standard or (c) is available only at an unreasonable price. For biobased content product designations, see <http://www.biopreferred.gov/ProposedAndFinalItemDesignations.aspx>.

5.12. CONSTRUCTION AND DEMOLITION (C&D) WASTE MANAGEMENT: Achievement of 50% diversion, by weight, of all non-hazardous C&D waste debris is required. Reuse of excess soils, recycling of vegetation, alternative daily cover, and wood to energy are not considered diversion in this context, however the Contractor must track and report it. A waste management plan and waste diversion reports are required, as detailed in Section 01 57 20.00 10, ENVIRONMENTAL PROTECTION.

5.13. SECURITY (ANTI-TERRORISM STANDARDS): Unless otherwise specified in Project Specific Requirements, only the minimum protective measures as specified by the current Department of Defense Minimum Antiterrorism Standards for Buildings, UFC 4-010-01, are required for this project. The element of those standards that has the most significant impact on project planning is providing protection against explosives effects. That protection can either be achieved using conventional construction (including

specific window requirements) in conjunction with establishing relatively large standoff distances to parking, roadways, and installation perimeters or through building hardening, which will allow lesser standoff distances. Even with the latter, the minimum standoff distances cannot be encroached upon. These setbacks will establish the maximum buildable area. All standards in Appendix B of UFC 4-010-01 must be followed and as many of the recommendations in Appendix C that can reasonably be accommodated should be included. The facility requirements listed in these specifications assume that the minimum standoff distances can be met, permitting conventional construction. Lesser standoff distances (with specific minimums) are not desired, however can be provided, but will require structural hardening for the building. See Project Specific Requirements for project specific siting constraints. The following list highlights the major points but the detailed requirements as presented in Appendix B of UFC 4-010-01 must be followed.

- (a) Standoff distance from roads, parking and installation perimeter; and/or structural blast mitigation
- (b) Blast resistant windows and skylights, including glazing, frames, anchors, and supports
- (c) Progressive collapse resistance for all facilities 3 stories or higher. Unless determined otherwise by the Installation and noted in paragraphs 3 or 6, the building shall be considered to have areas of uncontrolled public access when designing for progressive collapse.
- (d) Mass notification system (shall also conform to UFC 4-021-01, Mass Notification Systems)
- (e) For facilities with mailrooms (see paragraph 3 for applicability) – mailrooms have separate HVAC systems and are sealed from rest of building

## **6.0 PROJECT SPECIFIC REQUIREMENTS**

### **6.1. GENERAL**

The requirements of this paragraph augment the requirements indicated in Paragraphs 3 through 5.

### **6.2. APPROVED DEVIATIONS**

The following are approved deviations from the requirements stated in Paragraphs 3 through 5 that only apply to this project.

Additional Division 01 sections included in Appendix OO supplement the Division 01 sections of the RFP document. Comply with Appendix OO requirements.

6.2.1 The square footage of the building is smaller than the standard facility. Refer to Appendix J for the floor plan that applies to this project. The standard facility floor plans (Attachment B of this section) are provided for reference only.

6.2.2 Accessibility. Architectural Barriers Act of 1968 (ABA) established by public law requires any DoD building, except those specifically occupied only by able-bodied personnel, be accessible to the disabled. Therefore the Fire Station interior design as well as the exterior site circulation considerations shall meet the ABA standards for the Administration Office Area of the fire station.

6.2.3 Apparatus Bay. The apparatus bays shall be sized to accommodate all the authorized vehicles. Drive through bays are required. Bays must be readily accessible from the firefighter's residential portion of the station. Bays must include apparatus support equipment including exhaust collection systems, cold water fill, compressed air, floor drains, lighting and power. Bays shall be heated except in very temperate/tropical climates, but shall not be air conditioned except through exception.

**6.2.4** Referencing Section 01 10 00, Paragraph 3.7.5(j) Vending Area, power will be required for two vending machines.

**6.2.5** Referencing Section 01 10 00, Paragraph 3.7.5(a) Apparatus Bay, red green indicators shall indicate red unless door is in the fully opened position. Bay door opening/closing devices shall be located at each door opening and ramps leading into bay. Provide a total of 6 ceiling mounted self retracting electric cords between vehicles, location to be determined by customers.

**6.2.6** Referencing Section 01 10 00, Paragraph 3.7.5(d) Station Officer's Office/Watch Desk, Apparatus Bay door controls will not be required in this room.

**6.2.7 Referencing Section 01 10 00, Paragraph 3.7.5(m) Dispatch and Station Officer's Office/Watch Desk,** Apparatus Bay door controls will not be required in this room. All firefighting alerting system components, audio and visual, to include dorm room lights and corridor lights will be controlled via the First In by Westnet firefighting alerting system.



**6.2.8 Referencing Section 01 10 00**, Paragraph 3.7.7 Firefighting Alerting System, the firefighter alerting system shall be "First-In" manufactured by Westnet. The system shall be designed as a "smart station" encompassing all audio and visual alerting devices within and outside of the facility. The Westnet firefighter alerting system is the adopted firefighter alerting system for Fort Belvoir. Significant infrastructure is already in place in multiple existing facilities. The use of another system is not feasible due to pre-existing commitments and conditions of connectivity to established systems. The installation of the westnet system shall include connectivity to the Fort Belvoir and Fairfax County Fire and Rescue Dispatch Centers. This includes all required data/communications lines/ associated equipment, and any necessary programming to add this facility to the respective dispatch centers existing systems. Items included in the "smart station" design shall include: radio interfaces, satellight controller, dorm remotes, knight light system, active X-IT lighting, paging modules, outside satellight controller, high powered amplifier, video messengers, control remote, local activation units, speaker switches, visitor notification doorbells, emergency alert switch, and other components deemed necessary for system to fully function as a smart station alerting system."

**6.2.9 Referencing Section 01 10 00**, Paragraph 3.8.3 Cable TV (CATV) Requirements, add "all dorm rooms" in the third sentence between "Recreation Rooms," and "and Training".

**6.2.10 Section 01 78 02.00 10**, para 1.6, Revise submission requirements as stated here. O&M data shall be reviewed and approved by Government/DPW O&M staff and Fire department personnel. Once draft is approved, submit in 2 hard copies and 6 CD's. Package is to be indexed by manufacturer and product for ease of access.

6.2.11 Flooring, ceiling tile, floor base, paint, and other finish items shall be provided as stock for repair and replacement. All materials shall be provided in manufacturer unopened cartons. Floor tile--minimum of 2% or 2 boxes of each selection, whichever is greatest. Wall tile--minimum one box all color selections. Floor base--1 box of each; ceiling tile--if ceiling tile is used--minimum 2 boxes. Paint--5 gallons of each color.

6.2.12 Section 01 10 00, Paragraph 3.7.8. Delete "3.7.6.1" from the last sentence.

6.2.13 Section 01 10 00, Paragraph 3.7.8.1. Delete the sentence reading "Provide grounding points in vehicle and equipment parking areas on 40 foot centers (maximum), and coordinate with the power and data bollard units."

### 6.3. SITE PLANNING AND DESIGN

#### 6.3.1. General:

6.3.1.1. Project Location: This Two-Company Fire Station is located just off Gunston Rd between 15th and 16th Street. The

site can be accessed from Gunston Rd, 15th Street and 16th Street.

6.3.1.2 New Site Design and Construction. Organize the site and provide site improvements that are consistent with the

style of adjacent existing structures. The concept site plan presents an example layout for the site work. Design the drainage, sidewalk, landscaping, site grading, access roads, staff parking, visitor and admin parking, concrete apron, concrete curbs and gutters, and utilities for the fire station. Show limits of construction on the design drawings.

6.3.1.3. Constraints. In the future the area Northwest of 15th street will be developed. No Development may occur on

the east side of 15th street near the fire station. Contractor must remain within project limits or LOD during

construction. Project Managers will coordinate when request are made for permission to work outside of the limits. The project is in the historic area of the urban core zone and shall follow Fort Belvoir's Installation Design Guide's requirements for this zone.

No phase of construction shall impede access for emergency response vehicles to adjacent facilities. The Fort Belvoir

Fire Department and Military Police (Law Enforcement Office) shall be notified prior to any road closure and their directives followed.

Fort Belvoir is improving their major thoroughfares. This may still be occurring at the same time that construction of this project is scheduled. A map and schedule showing when access will be impeded is included in Appendix FF.

6.3.1.4. Temporary Construction Facilities/Job Conditions. The site is very limited for both a lay down area for construction materials and for parking for the contractor's work force. It is the Contractor's responsibility to provide adequate staff parking as well as transportation to the work site, if offsite parking is determined to be needed. Coordinate with Fort Belvoir DPW on approval for construction trailer location, material laydown and temporary parking.

6.3.1.5. Anti-Terrorism/Force Protection Criteria (AT/FP). Provide physical security and anti-terrorism/force protection for the site. Comply with the requirements of UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings. The Fire Station Is located within a controlled perimeter- as the post is fenced and has controlled access. The

Fire Station to include the Administration Office Area, Residential Living Area, and Apparatus Bay is considered to be

an inhabited building.

## 6.3.2. Site Structures and Amenities

Site exterior features such as the dumpster and mechanical features in accordance with UFC 4-010-01. Provide other security measures for the design such as protective bollards.

6.3.2.1 Dumpster Enclosure: Provide a dumpster enclosure to serve the new Fire Station. Locate the dumpster and its access from the

15th Street side of the project.

Provide a new reinforced concrete dumpster pad and access apron. The standoff distance

between the building and the dumpster is 33 feet for a controlled perimeter as indicated by UFC 4-010-01. The

pavement at the dumpster location shall be rigid pavement and designed based on the anticipated maximum loads and in

accordance with UFC 3-260-02. The location and orientation of the dumpster shall allow safe entry/exit and access to

the dumpster and ensure circulation of emergency vehicles is not impeded. Dumpster screening shall be provided and

designed to be aesthetically pleasing and coordinated with the building and surrounding site features. The dumpster enclosure shall be large enough to easily accommodate a standard front-loading type dumpster and to allow convenient access for unloading. Provide bollards to protect the enclosure from damage. At the rear inside of pad place provide either bollards or a raised concrete curb that will allow the dumpster to be pushed and stopped against while being loaded with the front load truck. This is to prevent the dumpster from being pushed against the enclosure and cause damage.

6.3.2.2 Equipment Enclosures: All equipment enclosures shall conform to the Installation Design Guide.

6.3.3. Site Functional Requirements:

6.3.3.1. Stormwater Management (SWM) Systems.

a. Stormwater Management strategy should assume that this site is considered redevelopment and water quality treatment shall be designed in accordance with Fairfax County Public Facilities Manual (PFM) and NOVA BMP Handbook. Preferable BMP's include tree boxes, Stormceptors, Stormfilters, or equivalent. The outfall should be provided to the nearest structure located along Gunston Road or 16<sup>th</sup> Street. The receiving pipe will be analyzed for capacity of the 10 yr. storm event. If receiving pipe does not have capacity, then storm sewer will be upgraded accordingly. Other applicable design standards include the VA Erosion and Sediment Control Handbook, 3rd edition, the VA Stormwater Management Handbook, 1st edition, and the Ft Belvoir MS4 permit (General Virginia Stormwater Management Program (VSMP) Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4s) Action, General permit 4VAC50-60-1240). An unofficial copy of the PFM is provided on the county Web site as a convenience. An official copy may be purchased from: Maps and Publications Center, Suite 156, 12000 Government Center Parkway, Fairfax, Va., 22035, 703-324-2974, TTY 711. DPW POC for Stormwater Management is Dorothy Keough at 703-806-0049.

b. Grading and Drainage: Site grading should preserve existing drainage patterns, vegetation, and other desirable site features. Other grading considerations include minimizing disturbance, site runoff, and balancing the quantity of cut and fill. Grade site in accordance with the minimum and maximum slope requirements indicated in UFC 3-210-06A according to the land use and provide drainage away from buildings. Avoid directing surface runoff over sidewalks and other pedestrian

paths. Parking areas should be graded to maintain a relatively constant slope with accessible parking areas graded according to UFAS and ADAAG standards. Site plans shall incorporate designs that control runoff and erosion. Rainfall intensity shall be determined from the best available intensity-duration-frequency data. All runoff onto the site from adjacent properties shall be included in the storm drainage calculations. Storm drainage system design shall be included in the design submittals. Site plan shall conform to the applicable requirements of the Commonwealth of Virginia, Fairfax County. Construct the drainage system such that parking areas and area adjacent to the new building drain adequately. Areas adjacent to the new building shall drain with storm water flowing away from the building. Utilize full curb and gutter (min 6 inch high) to direct, as needed, run-off into tree boxes that will treat for water quality before being released to the existing storm system in the area.

c. The finish floor elevation should be no less than 8 inches above surrounding site conditions, this is given as a reference as the final elevation is a design calculation requirement that is to prevent run-off from entering the facility.

#### 6.3.3.2. Erosion and Sediment Control

Permits: Obtain all permits including the Virginia Stormwater Management Permit (VSMP), Fort Belvoir excavation permit, and Fort Belvoir Land Disturbance Letter. Obtain all permits prior to any land disturbing activities or utility connections as prescribed by the respective permits.

#### 6.3.3.3. Vehicular Circulation.

Parking and Other Access Drives. Access drives to staff and public parking should not cross the vehicle

access drive out of the Apparatus Bay, unless it is unavoidable. Comply with UFC 3-210-02, POV Site Circulation and Parking and UFC 4-010-01 Minimum AT/FP Standards for Buildings. Comply with the requirements of the National Capital Planning Commission. Refer to HYPERLINK

"<http://www.ncpc.gov/project/>"<http://www.ncpc.gov/project/> for criteria and submission requirements.

a. Vehicle Movement and Parking Areas Criteria. The width, radii, and other geometric features of the access routes to

and from the Fire Station shall be sized to accommodate the vehicle sizes anticipated for fire station operations. The

second entrance shall be for privately owned vehicles (POV) and visitor parking and shall have a width, radii, and other

geometric features designed to accommodate the anticipated vehicles it will serve. Locate and design site entrances and

exits to provide safe sight distances for entering and exiting vehicles and allow safe movement to and from the site.

Access routes and parking areas shall be flexible pavement. Provide a rigid pavement parking apron at the entrance and

exit to the apparatus bays sized to fit the largest fire station apparatus. All pavement design shall be based on the

maximum loads and traffic anticipated and designed in accordance with UFC 3-260-02. Where curb and gutter are

provided, construct of portland cement concrete. The POV and visitor parking lot shall contain a minimum of 27 spaces

including accessible spaces. Accessible parking shall be provided in the POV and visitor parking lot in accordance with

UFAS and ADAAG standards, with the most stringent criteria governing. Accessible spaces should be located nearest

the entrance they routinely serve but no more than 100 feet from at least one accessible building entrance. Drive aisles

between parking bays shall be a maximum 24 feet in width. The POV and visitor parking shall also include provisions

for bicycle parking (bicycle rack in accordance with the IDG). Dead-end parking lots shall be avoided where possible. Provide sidewalks to separate vehicular and pedestrian traffic and safely convey pedestrians from parking areas to the building. The width of the sidewalk is to be determined based on anticipated pedestrian traffic with a minimum width of 4 feet. Provide curb cuts

and accessible ramps constructed per ADAAG requirements where required. The emergency vehicle exit road shall be located to allow emergency vehicles to exit the apparatus bays and proceed to the exit in a straight path to allow quick exit and minimal turning maneuvers. Design and install new traffic control measures to provide safe egress for fire station apparatus. New traffic controls shall be controlled by the Fire Station.

b. Pavement Markings. Pavement Markings shall be required for the new access roads and parking area. Marking stripes

shall be 4 inches wide. Parking strips shall be white and handicapped parking stripes shall be blue. Equipment used for

marking streets shall be capable of placing the prescribed number of lines at a single pass as solid lines, intermittent

lines or a combination of solid and intermittent lines using the maximum of two different colors of paint. When mobile

units are used to place thermoplastic material, the mobile unit shall be equipped with a spray gun system; however, thermoplastic material is not recommended. Material proposed for use shall be sampled and tested. Testing shall be performed in an approved independent laboratory and reports shall be furnished by the Contractor.

c. The existing parking lot along 16<sup>th</sup> Street (see attached concept drawing) will be used for the parking requirement of this project. Refurbish/reconfigure the lot to the same level of surface quality as the new pavement associated with this project. To meet the AT/FP stand-off requirements a portion of the west end of the lot may need to be removed. Handicapped spaces will be provided on the western end of this lot. See concept sheet C101 for existing parking lot to be used for this project. Since the parking lot exists and is not constructed under this project, LEED credit for fuel efficient vehicles will not be accounted for.

d. Design the parking lot drainage to provide positive drainage. Hold the slopes of the surface to the minimum required

for drainage and to prevent ponding, but not less than 1 percent. For safety, the maximum slope for parking shall be 5%

along the aisles through the parking areas and paved areas adjacent to the new facility drain adequately with water flowing away from the new facility.

e. Contractor proposed changes to the layout of the existing parking lot along 16th Street shall conform to AASHTO standards. The Contractor shall ensure that the layout for the entire site and access drives shall accommodate emergency and fire fighting vehicles, and are in accordance with NFPA 1 Uniform Fire Code. The fire truck route's inside and outside turning radii shall be a

minimum of 22 feet and 55 feet, respectively. Additional design and the parking lot traffic aisle shall be a minimum of 24 feet to provide two way movement.

f. Firefighting Vehicle Access Drives. Ensure that dimensions of access roadways and service entrances accommodate

vehicle sizes anticipated for fire station operations. Apparatus ramps should also be designed to support the anticipated

vehicle weight. Design the facility and site to permit drive-through Apparatus Bays. If the vehicle access drives are sloped, either for drainage or due to the site profile, ensure that the slope angle is low enough to be easily navigated by the firefighting apparatus and that the driver can maintain good visibility of the area around his or her vehicle.

g. To meet the setback requirements for Anti-Terrorism/Force Protection (AT/FP), a new right turn lane on 16<sup>th</sup> Street to Gunston Road is part of this project. Project includes all necessary utility/infrastructure relocations required to install this new right turn lane. It is the Contractor/Designer's responsibility to verify, design, fund, and indicate on the design submittals any/all utility/infrastructure that requires relocation for the new right turn lane construction. The existing right turn loop (see attached concept drawing) will be demolished as part of this project after the new lane has been installed, accepted by the DPW, and made operational. Timing of the removal of the existing access drive/connection across 16<sup>th</sup> Street to Gunston road will be coordinated with and approved by the Fire Department. The intersection of 16th and Gunston Rd is currently controlled by the existing Fire Station, therefore, controls need to be relocated to new facility. The length of the new right turn lane is limited to the 82 feet stand-off requirement for AT/FP, see sheet C101. Provide the new lane to the maximum length possible that will not encroach past the required stand-off distance in order to provide maximum number of vehicle as possible in the lane.

h. Modifications to the existing signal will be necessary to control the new right turn lane. Contractor shall supply all necessary materials to accomplish this.

#### 6.4. SITE ENGINEERING

##### 6.4.1. Existing Topographical Conditions

6.4.1.1. The proposed site is within Fort Belvoir on Gunston Rd between 15th and 16th Street. The site currently has two

historic buildings that will remain. Gunston road is a four lane paved road that primarily runs east and west through the

installation. The current site has large oak trees and is relatively flat. Verify existing conditions prior to beginning design.

6.4.1.2. Survey. Perform field topographic, planimetric, and utility surveys, office computations, 3D digital mapping and digital terrain modeling for use in developing the project design. Perform the survey under the general supervision of a licensed professional surveyor in the State of Virginia. Minimally survey the limit of construction indicated. Also complete utility investigation and survey topo and mapping outside of this limit necessary to construct a complete facility. Coordinate with the Fort Belvoir GIS office to obtain survey control.

6.4.1.3. Site Inspection. All soil boring and geographical testing and investigation required to design and construct the

facilities under this contract shall be the responsibility of the Contractor. All investigation results shall be submitted for

review in accordance with the requirements set forth in Section 01 33 16 DESIGN AFTER AWARD.

6.4.2. Existing Geotechnical conditions: See Appendix A for a preliminary geotechnical report.

See Appendix A for a preliminary geotechnical report.

6.4.2.1A preliminary geotechnical report has been prepared describing the general subsurface conditions in the vicinity of the project site. The geotechnical data and discussion in this report are intended to provide the Offeror with sufficient information to identify the general subsurface conditions at the site. The report also discusses geotechnical related requirements for the project and is included as "Appendix A - Geotechnical Report and Requirements". The

Contractor's team shall include a licensed geotechnical engineer who shall provide a complete geotechnical design and associated construction requirements. The contractor's geotechnical engineer shall perform a detailed site-specific geotechnical exploration/testing program to accurately characterize the site and form the basis of his design. There will be no separate payment for any of the required geotechnical involvement.

6.4.2.2 A final geotechnical evaluation report shall be prepared by the contractor's licensed geotechnical engineer and submitted along with the first foundation design submittal. This report shall summarize the subsurface conditions; provide recommendations for the design of appropriate foundations, floor slabs, retaining walls, embankments, pavements and any other geotechnical related features. The report shall discuss site stratigraphy, regional geology and all other features of the subsurface. The report shall analyze and provide necessary requirements for all items including but not limited to foundation type and capacities, foundation elevations, settlement analyses, lateral load parameters, slope stability, excavation support, and parameters for seismic design. Supporting documentation shall be included for all recommended design parameters. In addition, the report shall provide earthwork recommendations, expected frost penetration, expected groundwater levels, recommendations for dewatering and groundwater control, and discuss any surface or subsurface features that may affect the construction of the project. Additional discussion of geotechnical design requirements along with specific required assumptions for bidding are included in "Appendix A - Geotechnical Report and Requirements".

6.4.2.3 All requirements of the geotechnical report shall be incorporated into the plans and specifications. Locations of borings and test pits along with corresponding boring logs must be incorporated and shown on the construction drawings. The DB Contractor's professional geotechnical engineer consultant shall certify in writing that the design of the project has been developed consistent with the final geotechnical report. The certification shall be stamped by the consulting professional geotechnical engineer and shall be submitted with the first design submission. If

revisions are made to the initial design submission, a new certification shall be provided with the final design submission.

6.4.3. Fire Flow Tests See Appendix D for results of fire flow tests to use for basis of design for fire flow and domestic water supply requirements.

Results of the fire flow test reported in Appendix D are for reference only. Flow testing for design of fire flow and domestic water supply requirements shall be performed by the D/B contractor.

6.4.4. Pavement Engineering and Traffic Estimates:

The Contractor's geotechnical report shall contain flexible and rigid pavement design(s), supporting documentation of associated design parameters and discussion of related construction requirements. Detailed discussion of additional pavement related requirements is included in "Appendix A – Geotechnical Report and Requirements". Pavements shall be designed with a life expectancy of 25 years with normal maintenance.

6.4.5. Traffic Signage and Pavement Markings

Traffic markings, signs, and controls shall follow the MUTCD and State of VA DOT.

6.4.6. Base Utility Information

The following utility services will be required to serve the Fire Station and its associated site improvements: water, sanitary sewer, storm sewer, gas, communications, and electric. New service connections are required and existing services shall be capped at the main. Steam is available and must be considered during the life cycle cost analysis. Install utilities at the minimum depth necessary, typically not less than three feet or as indicated by the applicable UFC guidelines for the specific utility.

6.4.6.1 The Contractor is required to pay all costs for utility connection for the project, including payment required by the privatized utility.

See Paragraph 6.9

6.4.6.2 Water. Water infrastructure on Fort Belvoir is owned by American Water (AW). Construction plans for water must adhere to AW specifications and be approved by AW. Contract COR is Jim Eaton at (703)806-0060. Contact COR for information regarding plan submissions and construction requirements. All connections, valve turns and outages must be coordinated with AW and require inspections for new work. Existing water utilities are shown in Appendix J Drawings. A 12-inch diameter water main is located on 16th Street. A new fire main and water main, independent of one another, is required for the fire station. The new water and fire lines and associated appurtenances shall be designed in accordance with UFC 3-230-10A, American Water specifications (see appendices) and National Fire Protection Agency (NFPA) standards, latest edition. Fire Station water and fire demands are to be determined by the design-build contractor. Design-build contractor to perform flow testing to ensure adequate flow and system pressures. Where existing fire hydrants do not provide adequate coverage, new fire hydrants must be provided to ensure that all parts of each building's exterior are within a 350 foot hose-lay of a fire hydrant.



6.4.6.3 Sanitary Sewer. Sanitary sewer infrastructure on Fort Belvoir is owned by American Water (AW). Construction plans for sewer upgrades must adhere to AW specifications and be approved by AW. Contract COR is Jim Eaton at (703)806-0060. Contact COR for information regarding plan submissions and construction requirements. Existing sewer utilities are shown in Appendix J Drawings. An 8-inch diameter sanitary sewer main is located on 15th Street. A new sanitary service line will be required for the Fire Station and will connect and discharge to the existing sewer main. The new sanitary sewer line shall be designed in accordance with UFC 3-240-07FA and American Water specifications (see appendices).

6.4.6.4 Storm Sewer. Fort Belvoir manages a Municipal Separate Storm Sewer System (MS4) Program to review construction design plans for stormwater management and erosion and sediment control to ensure these plans are in compliance with the Virginia Stormwater Management Program (VSMP) General Permit. The Fort Belvoir DPW, ENRD office reviews construction plans for projects disturbing areas of 2500 square feet and greater to determine if the design plans are in compliance with Virginia and Fairfax County laws and regulations governing Virginia Erosion and Sediment Control Handbook (VESCH), the Fairfax County Public Facilities Manual (PFM) and the Virginia Stormwater Management Handbook (VSMH). Projects disturbing 5000 square feet or greater are reviewed for compliance with EISA07 Section 438 as well.

6.4.6.5 Gas. The Government Operating Contractor is Washington Gas and the POC is Ray Baker, 703-750-4486 or rbaker@washgas.com. An existing 8-inch gas line is located in 15th Street. A new gas service line will be required to serve the Fire Station with an anticipated connection to the existing gas line in 15th Street. Gas service requirements will be determined by the design-build contractor. A load letter will be required by the design engineer for submission to the service provider. Fees associated with the gas connection will be based upon load requirements and will be paid for by the designbuild contractor at no additional cost to the government. Refer to Appendix J for approximate existing gas utility locations and sizes. Refer to Appendix UA5 for the load letter form. POC for the Gas Privatization contract is Mr. David Hargett, 703-806-3765.

6.4.6.6 Communications. Communication services are provided by Verizon Federal and managed by the Fort Belvoir Network Enterprise Center. POC is Rondell Briggs, 703-704-1005, rondell.briggs@us.army.mil. There are two communication runs along 16th Street. The first is alongside the curb on the North side of 16th. The other duct bank is approximately 20 feet off the same curb. The connection point man hole for the Fire Station is MH-Z5. Refer to Appendix J for approximate manhole location.

#### 6.4.7. Cut and Fill

Balance cut and fill to the maximum extent practical. No disposal areas exist on Fort Belvoir.

#### 6.4.8. Borrow Material

No borrow areas are provided by the Government.

#### 6.4.9. Haul Routes and Staging Areas

Refer to the drawings in Appendix J.

**The route is the mandated route with access via Tulley Gate and Pohick Road, turning right on Theote Road, down to 16th Street--left on 16th to the project site. No haul roads are to be constructed off the project site. The route in and out for construction traffic is the same.**

#### 6.4.10. Clearing and Grubbing:

Clear and grub areas necessary for new construction while preserving existing trees and vegetation where possible. Protect trees that are determined to remain (at minimum) with orange construction safety fencing at a point of the drip line. During design review with the DPW on the grading and sediment and erosion plan the final tree preservation count will be determined. Provide adequate protection for existing vegetation to remain during construction. Record the diameter and species of all trees located within 25' of the proposed limits of clearing and grading, with a diameter breast height (DBH) equal to or greater than 4 inches. Collect data using DBH tape, hand lens, binoculars, core borer, soil auger, and survey equipment (or GPS unit). Identify any specimen tree (i.e., trees which have been determined to be of high value because of their species, size, age, form, historical significance, or other professional criteria, within the project area). These specimen trees shall be flagged, marked, and surveyed. Survey or GPS the locations of all recorded trees for inclusion on the survey map, a GIS data layer, and final report. Develop a tree survey report, with a map that shows all recorded trees at their GPS-determined longitude and latitude within 25' of the limits of clearing and grading. The report shall also contain a table, indicating species and condition summary of trees within the project boundaries. In accordance with the standards specified in the Fairfax County Public Facilities Manual (PFM) (HYPERLINK "<http://www.fairfaxcounty.gov/dpwes/publications/pfm/>"), also "<http://www.fairfaxcounty.gov/dpwes/publications/pfm/>"), also prepare an existing vegetation map (EVM). The EVM shall depict vegetative cover type areas, as specified in Table 12.2 of the PFM, that are 500 square feet or greater in area within the proposed project boundaries. This depiction shall include a list of the primary tree species in each cover type, a general statement regarding the successional stage of each cover type, and a statement regarding the general health and condition of each type. Prepare a condition analysis for all trees greater than 4 inches DBH for use in evaluating preservation potential and susceptibility to construction impacts for each tree within the project area. Prepare a mitigation proposal in accordance with agency requirements and the Integrated Natural Resources Management Plan (INRMP) of Fort Belvoir. Replacement of any tree with a DBH of 4" or more is required at a 2 replaced per 1 removed ratio.

#### 6.4.11. Landscaping:

- a. No vegetation is allowed at building footprint or within 10 feet of building. Large caliper trees trimmed up to 6 feet may be acceptable within the 33 feet perimeter after coordination with AT/FP officer.
- b. Avoid locating plantings that will conflict with utilities, either underground or overhead, both when planted and as the plantings mature.
- c. The plant selection shall be easy to maintain and enhance the visual quality of the facility in all seasons. Indigenous species are preferred. The growth characteristics of selected plant material should be assessed when considering line of sight requirements to either flight pavements or facilities. Comply with Unified Facilities Criteria (UFC) UFC 3-210-05FA, Landscape Design and Planting Criteria and the local Installation landscape standards. Select trees and shrubs that produce little or no debris. Avoid using plants that produce fruits or nuts that may attract unwanted animals and birds. Consider sustainable design issues when designing the landscape. Select plants that require little to no additional water beyond normal rainfall. Avoid plants that require an irrigation system or consider a gray water or storm water irrigation system.
- d. Use quality plant material as specified by the American Standards for Nursery Stock, ANSI 260.1. For areas that will be planted with turf/landscaping, test the soils for conditions and modify to bring soils to a condition that is correct for plantings (turfs, shrubs, plants, trees).
- e. GUARANTEE: Maintain the landscaping (prune, adjust guy wires, water, fertilize and weed) for a period of one (1) year after the acceptance of the project. Guarantee plants installed during the fall planting season until the following August 1; guarantee plants installed during the spring planting season until the following October 1. At the end of the warranty period, replace planting materials that die or have 25 percent or more of their branches that die during the construction operations or the guarantee period.

#### 6.4.12. Turf:

**Provide turfing in all disturbed and bare areas which are not paved or otherwise landscaped. Coordinate temporary and permanent seeding/sodding species selection and installation with the Erosion and Sediment Control Plans, Fort Belvoir Environmental Office. Temporary and permanent seeding/sodding species selection shall be updated to reflect new and approved cultivars that are hardier and more pest and disease resistant.**

a. Topsoil: Topsoil shall be fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, and free of subsoil, stones, clay or impurities, plants, weeds and roots. The soil (existing on-site topsoil and imported topsoil) shall be tested and modified as necessary to ensure soil and drainage conditions detrimental to plant growth are identified and corrected. Topsoil shall be free of invasive plants, invasive plant parts, or seeds of invasive plants such as those listed on the Virginia Department of Conservation and Recreation list found here at:

HYPERLINK

"[http://www.dcr.virginia.gov/natural\\_heritage/documents/invlist.pdf](http://www.dcr.virginia.gov/natural_heritage/documents/invlist.pdf)"[http://www.dcr.virginia.gov/natural\\_heritage/documents/invlist.pdf](http://www.dcr.virginia.gov/natural_heritage/documents/invlist.pdf) Suitable organic matter of topsoil should range from 7-10% and suitable pH should range from 5 to 7. Subsoil acidity of topsoil should be addressed. Where the subsoil is either acidic or composed of heavy clays, ground limestone shall be spread at the rate of 4-8 tons/acre (200-400 lbs per 1000 sq ft) prior to the placement of topsoil. Lime shall be distributed uniformly over designated areas and worked into the soil. Subsoil shall be tilled to a minimum depth of 6" before placement of topsoil. Topsoil shall be uniformly distributed in a 4-6" layer and lightly compacted to a minimum thickness of 4". Topsoil shall not be placed while the topsoil is in a frozen or muddy condition, when the subsoil is excessively wet or in a condition that may otherwise be detrimental to proper grading and seedbed preparation. If the stored site's topsoil is insufficient or not appropriate for the landscaping needs, additional topsoil shall be provided by the Contractor from an off-site source approved by the Contracting Officer's Representative (COR).

b. At the end of the warranty period the stand of turf shall be 95 percent ground cover of the established species.

6.4.13. Landfill/Disposal. Contractor shall be responsible for disposing of all spoils and debris off the installation. No landfill is provided by the Government.

6.4.14. Contractor's Use of Site.

6.4.14.1. The contractor shall coordinate with the Contracting Officer's Representative (COR) for laydown area, offices, parking, and storage facilities. Any damage to existing structure shall be repaired or replaced to the satisfaction of the COR at no additional cost to the Government. All Contractor POV parking areas shall be coordinated and approved in advance by the COR.

6.4.14.2. Construction sites shall be kept neat and free of trash. Construction sites shall be screened from view by a 6 foot high chain link fence with silt fabric attached. The construction fence shall be securely locked after working hours.

6.4.14.3. [Burning or borrowing of debris material is prohibited on the installation.](#) All liability of any nature resulting from the disposal of the materials shall be the responsibility of the Contractor. The Contractor shall be responsible for all disposal permits and fees associated with debris disposal.

6.4.15. Site Work Demolition. The project site is currently paved; remove pavement, curb, gutter, site improvements, etc. as required within the project limits. Additionally, demolition shall be required incidental to the new storm drain line construction. Refer to Appendix J Drawings for further information. The Record of Environmental Characterization (REC) can be found in Appendix E. Cap all existing utilities to be abandoned at the main supply line. Existing utilities to be abandoned and capped at main supply lines will be the responsibility of the designer to identify and indicate on design submittals. Abandonment and capping, and relocating utilities are the responsibility of the Contractor under this project.

6.4.16 Subgrade Treatment. Treat subgrades under all facility foundations to resist subterranean and other wood destroying insects known to exist in the vicinity of the site. Such treatment shall be in accordance with the environmental criteria referenced in this document.

## 6.5. ARCHITECTURE

6.5.1. General: To the maximum extent possible within the contract cost limitation, the buildings shall conform to the look and feel of the architectural style and shall use the same colors as adjacent facilities as expressed herein. The Government will evaluate the extent to which the proposal is compatible with the architectural theme expressed in the RFP during the contract or task order competition. The first priority in order of importance is that the design provides comparable building mass, size, height, and configuration compared to the architectural theme expressed herein. The second priority is that design is providing compatible exterior skin appearance based upon façade, architectural character (period or style), exterior detailing, matching nearby and installation material/color palettes, as described herein.

### 6.5.2. Design

6.5.2.1. Appendix F is provided "For Information Only", to establish the desired site and architectural themes for the area. Appendix F identifies the desired project look and feel based on Fort Belvoir's Installation Architectural Theme from existing and proposed adjacent building forms; i.e. building exterior skin, roof lines, delineation of entrances, proportions of fenestration in relation to elevations, shade and shadow effects, materials, textures, exterior color schemes, and organizational layout.

6.5.2.2. The design should address Fort Belvoir's identified preferences. Implement these preferences considering the following:

- (a) Achievable within the Construction Contract Cost Limitation (CCL)
- (b) Meets Milestones within Maximum Performance Duration.
- (c) Achieves Full Scope identified in this Solicitation
- (d) Best Life-Cycle Cost Design
- (e) Meets the Specified Sustainable Design and LEED requirements
- (f) Complies with Energy Conservation Requirements Specified in this RFP.

6.5.2.3. Priority #1. Visual Compatibility: Facility Massing (Size, Height, Spacing, Architectural Theme, etc.) Exterior Aesthetic Considerations: The buildings massing, exterior functional aesthetics, and character shall create a comprehensive and harmonious blend of design features that are sympathetic to the style and context of the Installation. The Installation's intent for this area is:

The following selections are representative of acceptable exterior materials (equal or better):

Brick: Glen Gery Extruded Series 200, Flash Matt or Carolina Ceramics Red

Wirecut

Grout (mortar): Flamingo, colored mortar, light tan in color. (use of colored dye(s) in mortar is not acceptable).

Roofing Material: GAF ELK Brand asphalt shingle, Timberline Cool Series, antiques slate color selection.

The building design should comply with Installation architectural standards. Also consider the local geographical and cultural environment. This building is within and adjacent to the Fort Belvoir Historic district; therefore, the architectural theme must be consistent with the Secretary of the Interior's Standards for the Treatment of Historic Properties. Design the building appearance to be compatible with the historic character of the area including but not limited to massing, scale, materials and architectural style, particularly Buildings 193 and 191. The Fire Station shall present a cohesive architectural image that will not result in an adverse effect to the national Register eligible Fort Belvoir Historic District. Create an attractive, functional theme that applies to the entire facility design, from the overall exterior architectural statement to the specific interior design elements. Continuity of space should be reinforced by space planning, building form, elevation, materials, and details.

6.5.2.4. Priority #2. Architectural Compatibility: Exterior Design Elements (Materials, Style, Construction Details, etc.) Roofs, Exterior Skin, and Windows & Door Fenestrations should promote a visually appealing compatibility with the desired character while not sacrificing the integrity and technical competency of building systems.

6.5.2.5. See Appendix F for exterior colors that apply to Architectural character at Fort Belvoir. The manufacturers and materials referenced are intended to establish color only, and are not intended to limit manufacturers and material selections.

6.5.2.6. Additional architectural requirements:

(a) Install fall protection anchor points on all roofs with a slope greater than 2:12

Additional architectural requirements:

a. Install fall protection anchor points on all roofs with a slope greater than 2:12.

b. Entrance. Ensure that the main Fire Station entrance is clearly identifiable to discourage visitors from entering the facility through an open Apparatus Bay door. In cold climates, provide a canopy (or a recess) at required egress doors to ensure that doors can completely open without obstruction from snow and ice. Provide separate entrances to the Dorm area and the Day Room.

c. Exterior Finishes. Exterior finishes should be durable and low-maintenance. Coordinate the exterior finishes with the Service-specific design standards noted below.

d. Exterior to match existing base materials.

e. Provide operable windows with screens throughout the facility.

**f. Referencing Section 01 10 00, Paragraph 3.4.3 Building Exterior, delete “Pre-engineered metal building systems are preferred for their factory finished metal siding and roof panels”. This style architecture is not consistent with this portion of Fort Belvoir. Pre-fabricated structure and or walls are not acceptable.**

**g. Referencing Section 01 10 00, Paragraph 3.7.1 Exterior Lighting, last sentence shall be read “Control lighting for all exterior applications by a photosensor AND astronomical time switch.....”.**

6.5.3. Programmable Electronic Key Card Access Systems:

Not Applicable

6.5.4. INTERIOR DESIGN

Construction and finishes (walls, floor, and ceiling) should support the cohesive image and theme of the facility as noted above. The living areas of the facility, such as the Day Room and the Dorm Rooms, should reflect a residential, non-institutional character. Durability is extremely important when specifying materials for interior construction and finishes. Fire Stations are occupied 24 hours per day, seven days a week and heavy equipment is regularly handled throughout the facility. These conditions will lead to greater interior damage being incurred compared to many other facility types. See Appendix P for specific design criteria.

6.5.4.1. Interior Construction.

a. Counters, casework, and cabinets should be of high-quality and durable construction. Specify Architectural Woodwork Institute (AWI) Premium or Custom for finishes per AWI Quality Standards Illustrated, Current Edition. Casework, cabinet doors, and drawer faces should be provided as veneer panel core. Doors, drawers, and casework faces should be plastic laminate at a minimum. Where no water source is present, countertops should be plastic laminate as a minimum with hardwood or solid surface edging. Where a water source is present, countertops should be solid surface/solid composite plastics only. Specify 20-mm (.75-in.) minimum thickness for plywood, plywood backing, and solid wood panels.

b. All interior glass must be tempered safety glass and mirrors must be constructed with break-resistant materials.

c. Clarification of Section 01 10 00, Paragraph 3.4.11.2: Use cement board in wet areas instead of gypsum board.

6.5.4.2. Finishes. Finishes should take into account the intended uses and be highly durable. They must meet the requirements listed in NFPA 101, Life Safety Code. Also coordinate the interior (and exterior) design with the following

Service specific standards or agencies:

- Army. DG 1110-3-122, Interior Design Guide and Installation Design Guide Standards.

6.5.4.3. Acoustics. Typical STC ratings range from 35 to 55 STC depending on the space and its intended use. During design, give special consideration to achieving the minimum required STC values by treating wall surfaces, wall openings, and the structure with sound attenuating materials.

The following locations are required to have sound insulation blankets meeting contract requirements and STC ratings:

Between Dorm Rooms; between Dorm Rooms and hallways; between Recycle Room and end Dorm Rooms (2 locations); between Kitchen/Dining and end Dorm Room; between SCBA Maintenance Room and adjacent Dorm Room; between Men's Room and Day Training Room; between Station Office/Watch Desk and Work/Equipment Room; Between UPS Room and Station Office/Watch Desk; between Laundry Room and Inspection Room, Fitness Room and Hallway; between Men's and Women's Rooms.

6.5.4.4 Referencing Section 01 10 00, Paragraph 3.4.6, in the Apparatus Bay paint floor with nonskid abrasive epoxy floor covering.

**6.5.4.5 Referencing Section 01 10 00, Paragraph 3.4.5 Floors, floor drains shall be no less than 22 inches wide, full length, located parallel to the centerline of each vehicle bay.**

**6.5.4.6 Referencing Section 01 10 00, Paragraph 3.4.6 Natural Lighting, all operational windows shall have screens.**

**6.5.4.7 Referencing Section 01 10 00, Paragraph 3.4.7 Apparatus Bay Doors, change overhead doors to 14 feet x 14 feet, 4 fold fire station doors with vision panels, factory powder coated white, electric opening, RF remote control opening and closing, manual override.**

**6.5.4.8 Referencing Section 01 10 00, Paragraph 3.4.8 Personnel Doors, add Dorm Room doors to the list of exceptions.**

**6.5.4.9 Referencing Section 01 10 00, Paragraph 3.4.10.2 Minimum Interior Finishes, Floor finish Room by Room Kitchen/Dining Room, Hallways, Vending Area, Corridors, Laundry, & Storage Room's shall have Quarry Tile flooring. Dorm Rooms, Offices, Fitness Room, Watch Room, & Day Room/Training Room shall have carpet flooring. PPE Storage, Apparatus Bay Floor, SCBA Maint, SCBA Compressor Room, Protective Clothing Laundry, EMT Storage, Equipment Wash/Disinfection, Work Room/Equipment Maint, & Ramps leading into the apparatus bays shall be 3/16 in./5 mm epoxy aggregate flooring with cove base comparable to Stoneblend GSI Mechanical Room, UPS, IT Room shall be sealed concrete.**

**6.5.4.10 Room By Room User Specific Requirements:**

**a. Apparatus Bay. Doors shall be four fold firehouse doors factory powder coated white, with vision panels. Exposed ceiling components and structures shall be painted flat black. Apparatus bay flooring shall be 3/16th inch/ 5 mm epoxy aggregate flooring comparable to stoneblend gsi Floor drains shall run full length parallel to center line to the front of the center line of the bays and shall be a minimum of 22 inches wide Vehicle exhaust system shall be a Plymovent hose**

**system lighting red/green indicator for bay doors shall indicate red unless door is fully opened. Provide 4 cold water hose bibs located one between each bay door. Provide 2 telephones on opposing corners of the apparatus bays. Provide data drops at location of the telephones.** Provide a cold water (potable) supply with connection, drain, and electric supply outlet to allow the installation of a free standing commercial grade ice maker in the apparatus bay area. **Provide an audio alarm that will sound at any time an apparatus bay door is in motion.**

**b. PPE Gear Storage Room. Flooring shall match the apparatus bay floors. Lockers shall be minimum of 72 inches tall, 18 inches wide, and have lockable doors. Minumum number of lockers shall be 30.**

**c. SCBA Maintenance Room. Flooring shall match apparatus bay floors.**

**d. SCBA Compressor Room. Flooring shall match apparatus bay floor.**

**e. Protective Clothing Laundry. Floor shall match apparatus bay floor. One telephone is required for this space.**

**f. Equipment Wash and Disinfection. Floor shall match apparatus bay floor. One telephone required for this space.**

**g. Workroom Equipment Maintenance. Floor shall match apparatus bay floor.**

**h. EMS Equipment Storage. Floor shall match apparatus bay floor.**

**i. Installation Preferred Flooring Betterments:**

- 1) Station Officer's Office/Watch Desk. Preferred flooring is durable commercial carpeting.**
- 2) General Administration Storage. Preferred floor is durable commercial carpet.**
- 3) Lobby. Preferred floor is quarry tile.**

**j. Public Toilet. Provide slip resistant ceramic tile floor. Provide full height hard tile finish on all walls that is impervious to water and shall be able to withstand daily sanitizing.**



**k. Telecommunications Room. Flooring shall be sealed concrete floor. Provide a buss bar for grounding of equipment.**

**l. Computer Testing Room. Flooring shall be durable commercial carpet. Provide 2 telephone, 2 cable TV drops, and 2 data drops, location to be determined by customer. Add a non-loading bearing wall with door, separating the space into two individual testing rooms with adjustments to building systems necessary for rooms to function independently.**

**m. Day/Training Room (includes Kitchen). Plumbing shall include a sink sprayer. Wall construction in the kitchen area shall be full height hard tile finish. Kitchen exhaust hood shall include a wet chemical fire suppression system appropriate for cooking equipment. Free standing ice maker will be located in apparatus bays not kitchen, space will contain 2 separate commercial refrigerators and 2 separate commercial freezers. If separate pantry area, provide built in shelving units. Preferred flooring is quarry tile.**

**n. Dorm Rooms. Floor shall be durable commercial carpet. Dorm room wall locker options are required in all dorm rooms Size of lockers to be determined in design phase provide one quad electrical outlet located between beds. All walls shall be gypsum wall board with egg shell paint. Provide brackets for wall mount TV. Provide electrical and CATV connections adjacent to wall mount TV brackets, location to be determined in design phase. Provide ceiling fan.**

**o. Men's Bathroom/showers. All showers will require privacy frosted glass shower doors, the use of shower curtains will not be permitted. Urinals will not be of waterless type.**

**p. Women's Bathroom/showers. All showers will require privacy glass shower doors, the use of shower curtains will not be permitted.**

**q. Fitness Room. Flooring shall be durable commercial carpet. Full wall height mirrors are not required in this room.**

**r. Laundry Room. Preferred floor is quarry tile.**

**s. Corridor. Preferred flooring is quarry tile.**

**t. Vending. Preferred flooring is quarry tile.**

**u. Recycle Room. Flooring shall be durable commercial carpet. Provide a carbon monoxide detector. Provide 1 telephone, 1 data drop, 1 CATV drop.**

**v. Patio. Provide area lighting above natural gas line connection.**

**w. Spring loaded hinges are not an acceptable closure mechanism for any doors requiring a self closing device.**

**6.5.4.11 Referencing Section 01 10 00, Paragraph 5.6.7 Urinals, Perfer the use of water urinals due to problems experienced in other facility using waterless type.**

Interior building signage requirements:

Provide signage similar to Belvoir North Fire Station

## **6.6. STRUCTURAL DESIGN**

Single-story structures are preferred for Fire Stations. Site constraints may drive the need for multi-story structures. If a multi-story structure is required, ensure the appropriate adjacencies are maintained so that the required response times may be achieved. Where possible, design the structural system to accommodate future expansion requirements without over-designing the initial construction.

6.6.1. Foundation. The foundation is site specific and must be designed upon known geotechnical considerations by an engineer knowledgeable of the local conditions.

6.6.2. Superstructure. Clear spans are preferred for the Apparatus Room. Provide most economical and functional superstructure.

6.6.3 Special Design Considerations and Requirements Windows, skylights and glazed door frame members, connections to surrounding walls or roof, hardware and associated connections, and glazing shall be designed for blast protection by the designer of record in accordance with UFC4-010-01. Review Code B.

## **6.7. THERMAL PERFORMANCE**

no special project requirements.

## **6.8. PLUMBING**

6.8.1 Do not use triple duty valves or automatic flow control valves.

6.8.2 Do not use mineral fiber insulation on any cold water piping. Do not use polyolefin and phenolic foam insulation for plumbing insulation.

6.8.3 Connect a waterflow sensor or other device to the Alarm Room, so as to alert other personnel if the emergency shower or eyewash is activated.

6.8.4 Provide an Oil Water separator in the apparatus bays.

6.8.5 Referencing Section 01 10 00, Paragraph 3.6.2.1 Drains, floor drains shall be no less than 22 inches wide, full length, located parallel to the centerline of each vehicle bay.

6.8.6 Referencing Section 01 10 00, Paragraph 3.6.2.5 Hose Bibs, total 4 in apparatus bays with metal hose hanging bracket, located between each bay door, front and rear.

6.8.7 Referencing Section 01 10 00, Paragraph 3.6.3.1 Vehicle Exhaust System, Vehicle Exhaust Removal System shall use Plymovent to maintain

current system wide compatibility.

6.8.8 Referencing Section 01 10 00, Paragraph 5.6.7 Urinals; do not provide non-water type urinals.

## 6.9. SITE ELECTRICAL AND TELECOMMUNICATIONS SYSTEMS

### 6.9.1 Site Electrical

The Fort Belvoir DPW POC is Mr. Anhhuy (Jim) Huynh, at (703) 806-4558 or anhhuy.t.huynh.civ@mail.mil. Dominion Virginia Power (DVP) is the Government Operating Contractor for Fort Belvoir. POC is Rich Gillen, 703-838-2287 or rich.gillen@dom.com. Refer to Appendix UA3 for load letter and paragraph 3.7 for requirements. Refer to Appendix J for approximate existing electric utility locations and sizes. Newly installed system infrastructure and modifications of or connections to existing system infrastructure must be coordinated with DVP. DVP shall be integrated into the design, inspection of construction, tie-in to existing utilities, and conveyance of any exterior utilities. The preferred process for connecting facilities is to request that DVP install the required connecting facilities, up to a point of demarcation to be identified by the Government, as a connection charge to be paid by the Contractor. However, if a connection charge cannot be negotiated by the Contractor, work may be accomplished by the Contractor and later connected to DVP's system, provided that the DVP's connection criteria, as set forth in their utility services contract with the Government, are met. The DVP connection charge and/or any fees associated with connecting Contractor constructed infrastructure to the DVP's system must be negotiated with and paid to DVP by the Contractor. All work on the system or facilities expected to connect to the system shall comply with DVP's specifications and construction standards. In no event shall Contractor cap, connect to, or otherwise touch DVP's infrastructure without DVP's express written permission. Coordinate with DVP during design and construction to include submittal of DVP Load Letter and providing DVP with all project AutoCAD drawing files required by DVP in order to provide service to the facility. Point of demarcation is defined as follows: DVP designs/installs primary service including primary duct, primary cable, transformer pad and transformer. DVP provides, installs, and terminates the secondary cable in the Contractor provided duct from the transformer to the facility service entrance disconnecting means. DVP provides but the Contractor installs meter base, CTs, and CT Cabinet.

### 6.9.2 Telecommunication

Provide a two-way 4" duct bank from Manhole Z5 to the Telecommunications Room in the fire station. Provide four 1 inch innerducts in one duct. Provide pull cords in all ducts and innerducts. See Appendix C and J for locations. The Point of Contact is Rondell Briggs (703) 704-1005 or rondell.briggs@us.army.mil. Contact the POC for outside comm point of access.

## 6.10. FACILITY ELECTRICAL AND TELECOMMUNICATIONS SYSTEMS

6.10.1 All outdoor lights shall be full cutoff. Clarification of Paragraph 3.7.1.1 Site Lighting; Fort Belvoir prefers that parking lot lights be LED type and controlled by photo light sensor and astronomical time switch.

6.10.2 Arc-Fault Circuit Interrupts to be installed in all sleeping rooms, and in all places required by the most current NFPA 101.

6.10.3 Provide convenience outlets at maximum 10 foot intervals along the walls.

6.10.4 As additional requirements for the IT room, install a kill switch in accordance with 29 CFR 1910.306(e)(1) and NFPA 70, 645.10.

6.10.5 As additional requirements for the vending area, outlets shall be GFCI per NFPA 70, 422.51.

6.10.6 Electric water coolers outlets shall be GFCI per NFPA 70, 422.51.

6.10.7 Referencing Section 01 10 00, Paragraph 3.7.7(j) Vending Area, power is required for two vending machines.

6.10.8 Referencing Section 01 10 00, Paragraph 3.7.7(a) Apparatus Bay, red green indicators shall indicate red unless door is in the fully opened position. Bay door opening/closing devices shall be located at each door opening and ramps leading into bay. Provide a total of 6 ceiling mounted self retracting electric cords between vehicles, location to be determined by customers. Provide an audio alarm that will sound at any time an apparatus bay door is in motion.

6.10.9 Referencing Section 01 10 00, Paragraph 3.7.7(d) Station Officer's Office/Watch Desk, Apparatus Bay door controls will not be required in this room.

6.10.10 Referencing Section 01 10 00, Paragraph 3.7.7(m) Dispatch and Station Officer's Office/Watch Desk, Apparatus Bay door controls will not be required in this room. All firefighting alerting system components, audio and visual, to include dorm room lights and corridor lights will be controlled via the First In by Westnet firefighting alerting system.

6.10.11 Referencing Section 01 10 00, Paragraph 3.7.9 Firefighting Alerting System, the firefighter alerting system shall be "First-In" manufactured by Westnet. The system shall be designed as a "smart station" encompassing all audio and visual alerting devices within and outside of the facility. The Westnet firefighter alerting system is the adopted firefighter alerting system for Fort Belvoir. Significant infrastructure is already in place in multiple existing facilities. The use of another system is not feasible due to pre-existing commitments and conditions of connectivity to established systems. The installation of the westnet system shall include connectivity to the Fort Belvoir and Fairfax County Fire and Rescue Dispatch Centers. This includes all

required data/communications lines/ associated equipment, and any necessary programming to add this facility to the respective dispatch centers existing systems. Items included in the "smart station"

design shall include: radio interfaces, satellite controller, dorm remotes, knight light system, active X-IT lighting, paging modules, outside satellite controller, high powered amplifier, video messengers, control remote, local activation units, speaker switches, visitor notification doorbells, emergency alert switch, and other components deemed necessary for system to fully function as a smart station alerting system.

6.10.12 Revise the first sentence of Section 01 10 00, Paragraph 3.7.2 to read "Provide fluorescent luminaires or equal lighting with premium efficiency electronic programmed start fluorescent ballasts."

6.10.13 Provide infrastructure only for voice/data and CATV systems. Provide pull cords in all conduits. Also provide conduit stub-out from the main telecommunication room for the CATV commercial service provider.

6.10.14 The mass notification system shall be compatible with the base system and, contrary to Paragraph 3, the mass notification system shall not be combined with the PA system.

6.10.15 Provide rough-in of conduits, boxes, and pull wires for a structured cabling system to be installed by others. Provide telecommunications grounding and bonding infrastructure per I3A and ANSI-J-STD-607-A. Provide telecommunications pathways and spaces per I3A and TIA-569-B.

6.10.16 Referencing Section 01 10 00, Paragraph 3.8.1 Service, the following service shall be coordinated with NEC, POC Mr. Rondell Briggs at (703) 704-1005: the installation of T-1 lines, analog phone lines, digital phone lines, required data drops, and specific numbers and locations of handsets required for the facility.

6.10.17 Referencing Section 01 10 11, Paragraph 3.8.3 Cable TV (CATV) Requirements, Cable TV Outlets shall be provided in all dorm rooms. POC Mr. Rondell Briggs at (703) 704-1005

6.10.18 Complete an arc flash hazard analysis in accordance with NFPA 70E and IEEE1584. Use references NFPA 70E, IEEE 1584 and ANSI Z535.4 for arc flash hazard analysis.

#### 6.11. HEATING, VENTILATING, AND AIR CONDITIONING

a. To ensure durability, consider climate conditions, high humidity, industrial atmosphere, salt water exposure, or other adverse conditions when selecting exterior HVAC components.

b. Provide pipeline thermometers to measure supply and return water temperatures for heating and chilled water systems. Provide thermometer wells on the supply and return side of air handling unit heating and chilled water coils. Provide a pressure gauge at the suction and discharge of each pump and across the pump's strainer. Provide pressure/temperature gauge cocks as close as possible to the entering and leaving connections to heating and cooling equipment, coils and heating elements.

c. Carbon Monoxide detectors are required in the residential and administrative areas.

d. Facility HVAC Controls are not required to be integrated into the Base Wide LAN System. Connection to the existing UMCS is not an option because the existing UMCS belongs to Pepco.

e. Referencing Section 01 10 00, Paragraph 3.6.3.5 design the system to allow a minimum cooling temperature of 60-65 degrees.

f. Mechanical insulation shall not be composed of Polyolefin or Phenolic. Do not use mineral fiber insulation on any cold water piping.

- g. Do not use triple duty valves or automatic flow control valves.
- h. M&C software shall be licensed for no less than 2 clients and no less than the number of points in the building automation system.
- i. Provide a Plymo Vent vehicle exhaust removal system. Plymo Vent shall consist of three full length drive thru collection hoses and one half length collection hose. Connections to vehicles shall be right side near rear tire. Exact location and collar size TBD at design phase.

## 6.12. ENERGY CONSERVATION

### 6.12.1. General

Energy Conservation activities shall support Executive Order 13423, the Energy Policy Act of 2005 and other Executive Orders and Presidential Directives and relevant laws. Provide Energy Compliance Analysis per UFC 3-400-01, Energy Conservation. In order to maximize the fire station energy savings capabilities and comply with the LEED-NC certification criteria, the following various energy conservation measures shall be used or further evaluated during the design process:

- Air handling units shall have air side economizers allowing 100% free cooling
- AFD's shall be used for all major air moving devices and pumps
- High efficiency equipment & high efficiency motors shall be selected for all applications
- Energy & Life Cycle Cost Analysis shall be performed on various HVAC options and technologies
- For primary source of heating / cooling - options considered shall not be limited to
  - a. ground source heat pumps , or
  - b. Other renewable energy sources / systems
- Choose energy efficient strategies & technologies that will achieve LEED-NC minimum performance goal
- HVAC equipment shall be equipped with DDC controls & should possess stand alone capabilities
- HVAC electronic control system shall be compatible with site's central DDC Energy Management Control. (Johnson Metasys management system)
- **Thicker exterior walls**
- **Additional wall, roof, and floor insulation above code minimum**

6.12.2. Inclusion of Renewable Energy Features. The following renewable energy features have been determined lifecycle cost effective, are included in the project budget and shall be provided:

Solar Hot Water system providing 30% of domestic hot water demand

## 6.13. FIRE PROTECTION

### 6.13.1 GENERAL

The Fire Station shall be provided with a combined fire alarm and mass notification system, complete automatic sprinkler protection, and portable fire extinguishers. The fire alarm system shall be provided in accordance with NFPA 72. The automatic sprinkler system shall be provided in accordance with the UFC 3-600-01 and NFPA 13. Portable fire extinguishers shall be provided in accordance with NFPA 10. Carbon monoxide detectors are required to be located in the residential and administration areas. POC for Fort Belvoir Fire Station is John Weaver, 703-805-2091, john.h.weaver@us.army.mil.

The installations' proprietary fire alarm system is the Kingfisher.

#### 6.13.2. FIRE PROTECTION ENGINEER

6.13.2.1 The contractor shall provide the services of a qualified registered fire protection engineer. The fire protection engineer shall be an integral part of the design team and shall be involved in all aspects of the design of the fire protection systems. As a minimum, the fire protection engineer shall design the automatic sprinkler system; the fire alarm system; the mass notification system; the fire pump (if applicable); and the KING-FISHER fire alarm radio transmitter.

6.13.2.2 Fire Protection and Life Safety Analysis: The fire protection engineer shall perform a fire protection and life safety design analysis of the proposed facility design. The analysis shall be submitted with the preliminary design submittal. The analysis shall include type of construction; height and area limitations; classification of occupancy; building separation or exposure protection; specific compliance with NFPA codes and the IBC; requirements for fire-rated walls, doors, fire dampers, etc.; analysis of automatic suppression systems and protected areas; water supplies; fire alarm system, including connection to the base-wide system; fire detection system; fire extinguishers; interior finish ratings; and other pertinent fire protection data. The submittal shall include a life safety floor plan showing occupant loading, occupancy classifications and construction type, egress travel distances, exit capacities, sprinklered areas, fire extinguisher locations, ratings of fire-resistive assemblies, and other data necessary to exhibit compliance. The design analysis shall be updated at each design submittal.

#### 6.13.3 FIRE PROTECTION REQUIREMENTS FOR THE BUILDING AS APPLICABLE

##### 6.13.3.1 ADDRESSABLE FIRE ALARM AND MASS NOTIFICATION SYSTEM

6.13.3.1.1 The combined fire alarm and mass notification system shall comply with the latest edition of NFPA 72. The system shall be general alarm and noncoded. It shall utilize an addressable microprocessor based type system with manual and automatic alarm initiation. Signal transmission shall be a multiplex format and be dedicated to fire alarm service only. "Shared" systems (security and/or energy management) shall not be permitted. All fire alarm equipment must be UL (Underwriters' Laboratories) listed for its intended purpose in the "Fire Protection Equipment Directory".

6.13.3.1.2 Audible fire alarm indication shall be via electronic speakers. Visual alarm indication shall be by synchronized strobes. Provide two sets of strobes: Fire alarm strobes with clear lens marked with the word "FIRE" and Mass Notification strobes with amber lens marked with the word "ALERT." Spacing and location of speakers and strobes shall be commensurate with the ADA (Americans with Disabilities Act); the NFPA 72; and any other applicable codes.

6.13.3.1.3 The NAC (Notification Appliance Circuits) shall be Class "A". The SLC (Signal Line Circuits) shall be class "A", Style "6". The AID (Alarm Indicating Device) circuits shall be Class "A". All circuits shall have at least 40% spare capacity for additional devices (initiating and indicating) in each building. Wiring and conduit for the alarm initiating devices (pull stations, water flow, smoke detectors, etc.) may not be shared with the wiring and conduit for the alarm indicating devices (horns/speakers and strobes). Minimum conduit size shall be ¾ inch.

6.13.3.1.4 All signals from the fire alarm panel shall be transmitted to the Ft. Belvoir Fire Department fire alarm receiving station. The fire alarm control panel shall require an accompanying radio transmitter. The transmitter shall be identical to the current base wireless manufacturer and shall be added to the existing base receiving system. The

Base uses a KING-FISHER radio transmitter system. The fire alarm radio transmitter shall be compatible with the existing base receiving equipment. The fire alarm radio transmitter shall be compatible with the existing base receiving equipment. Fire alarm system shall be point to point addressable from the building to the Fort Belvoir ECC compatible with the existing base requirement.

6.13.3.1.5 Manual pull stations shall be provided at 48 inches above the floor at all exterior doors and egress points from the building (including mechanical room doors, electrical room doors and boiler room doors).

6.13.3.1.6 All wire shall be solid copper. Minimum wire size shall be #12 AWG for 120 volts AC circuits. Minimum wire size shall be #16 AWG for 24 volts DC circuits. Alarm initiating circuits shall utilize twisted-shielded pair wiring with a foil shield and a #16 AWG drain wire as recommended by the manufacturer. Do not use shielded wire if it is not recommended by the FACP manufacturer. Alarm indicating circuits shall be minimum # 16 AWG solid copper and shall follow the manufacturers' recommendation as to cable construction.

6.13.3.1.7 All wire shall be installed in conduit, 3/4 inch minimum. All wiring and conduit shall be laid at right angles. All wiring and conduit shall be installed concealed unless in an unfinished area. Wiring and conduit for the alarm initiating devices (pull stations, water flow, etc.) shall be completely segregated from the wiring and conduit for the alarm indicating devices (horns and strobes). Paint all conduit for the fire protection system red.

#### 6.13.3.2 AUTOMATIC SPRINKLER SYSTEM

6.13.3.2.1 The building shall be fully protected with an automatic wet-pipe sprinkler system. The wet-pipe sprinkler system design shall be in accordance with UFC 3-600-01 (Design: Fire Protection Engineering for Facilities), and NFPA 13.

6.13.3.2.2 No copper or plastic sprinkler piping shall be allowed. Copper/brass piping shall be permitted in conjunction with the trim out of only the fire pump/ jockey assemblies. All sprinkler piping shall be black steel schedule 40 and schedule 10. Paint all exposed sprinkler system piping red.

6.13.3.2.3 The fire department connection shall be 4 inch stortz connection.

#### 6.13.3.3 FIRE WATER SUPPLY

6.13.3.3.1 The contractor must perform a detailed water analysis of the site. Some hydraulic data must be extrapolated from adjacent water supply piping.

6.13.3.3.2 The contractor, in the immediate vicinity of the proposed site plan, shall conduct multiple fire hydrant flow testing. The flow tests shall be coordinated with the Fire Chief and/or the DPW. Prior flow test information is included but shall not be used for the design of the system. The contractor shall utilize their flow test data and hydraulic analysis as the basis for the water supply design. Perform flow testing in accordance with NFPA 291. Discrepancies between the flow test data obtained by the contractor and the flow test data provided below shall be reported immediately to the Contracting Officer.

#### 6.13.3.4 PORTABLE FIRE EXTINGUISHERS

Provide portable fire extinguisher locations in accordance with NFPA 10 for spacing and quantity throughout the building (unless otherwise noted). Referencing Section 01 10 00, Paragraph 3.2.4.3 Fire Extinguishers- provide flush mounted aluminum or steel fire extinguisher cabinets with clear view panels in finished space. Provide fire-rated cabinets in fire-rated wall assemblies. Provide fire extinguishers hooks in unfinished space.

#### 6.13.3.5 WATER DISTRIBUTION SYSTEM

6.13.3.5.1 The water distribution system shall be in accordance with UFC 3-600-01 (Design: Fire Protection Engineering for Facilities) and NFPA 24.



6.13.3.5.2 Fire Hydrants must be distributed such that all parts of the building exterior are within 350 ft (106m) of a hydrant (new or existing).

6.13.3.5.3 A new or existing fire hydrant must be within 150 ft (45m) of the new fire department connection serving each automatic sprinkler system.

#### 6.14. SUSTAINABLE DESIGN

6.14.1. LEED Rating Tool Version. This project shall be executed using LEED-NC Version 3.

6.14.2. The minimum requirement for this project is to achieve LEED Silver level. Each non-exempt facility (building plus sitework) must achieve this level. In addition to any facilities indicated as exempt in paragraph 3, the following facilities are exempt from the minimum LEED achievement requirement: None.

6.14.3. Credit Validation: LEED registration, compiling of documentation at LEED OnLine and use of the LEED Letter Templates is required. Registration and payment of registration fees will be by the Contractor. Administration/team management of the online project will be by the Contractor. Validation of credits will be accomplished by the Government. LEED certification of the project by the Contractor is not required. The Government may choose to seek LEED certification of the project, in which case the Government will pay certification fees and coordinate with the GBCI and the Contractor will furnish audit data as requested at no additional cost.

6.14.4. Commissioning: See Appendix M for Owner's Project Requirements document(s).

6.14.5. LEED Credits Coordination. The following information is provided relative to Sustainable Sites and other credits.

#### **SS Credit 1 Site Selection:**

Project site IS NOT considered prime farmland.

Project site is five feet or more above 100-year flood elevation.

Project site contains no habitat for threatened or endangered species.

No portion of project site lies within 100 feet of any water, wetlands or areas of special concern.

Project site WAS NOT previously used as public parkland.

#### **SS Credit 2 Development Density & Community Connectivity.**

Project site DOES meets the criteria for this credit.

#### **SS Credit 3 Brownfield Redevelopment.**

Project site DOES NOT meets the criteria for this credit.

#### **SS Credit 4.1 Public Transportation Access.**

Project site DOES meets the criteria for this credit.

#### **EA Credit 6 Green Power.**

35% of the project's electricity WILL NOT be provided through an Installation renewable energy contract. Do not purchase Renewable Energy Credits (REC's) to earn this credit.

**MR Credit 2 Construction Waste Management.**

The Installation does not have an on-post recycling facility available for Contractor's use.

**Regional Priority Credits (Version 3 only)**

The project zip code is 22060.

6.14.6. LEED Credit Preferences, Guidance and Resources. See Appendix L LEED Project Credit Guidance for supplemental information relating to individual credits.

6.14.7. Not Used

6.14.8. Additional Information

6.14.8.1 Installation does not support credit for providing spaces for Low Emitting/Fuel Efficient Vehicles (currently SS Credit 4.3).

**6.15. ENVIRONMENTAL**

Fort Belvoir has identified no environmental concerns related to soil. If the Contractor encounters any contaminated soil, report it to the Contracting Officer's Representative (COR) immediately. The Contractor shall comply with all Local, State, and Federal environmental requirements. The Record of Environmental Characterization (REC) may be found in the Appendices.

6.15.1 Fort Belvoir is located within the Costal Zone Management program authorized to designate Resource Protection Areas (RPAs) to be conserved from development. The project site is not located within a RPA.

6.15.2 If underground tanks, soil odor/discoloration, or other unknown hazardous items are encountered during construction, the contractor and/or their sub-contractors will STOP WORK, then notify the COR and contact the DPW-ENRD immediately at 703-806-0030 (Amy Martin) or 703-806-3694 (Ben Wallen).

6.15.3 A HAZWOPER certified/trained individual shall be onsite during earthwork/land disturbing activities. If removal of contamination is required, comply with all Local, State, and Federal regulations.

6.15.4 The Fort Belvoir natural resource plan requires a 2:1 replacement policy for all trees removed during construction that are greater than 4 inches in caliber. The Landscape Plan will detail the trees planted in compliance with this requirement.

**6.16. PERMITS**

Coordinate all permits through Fort Belvoir DPW. Contacts are listed below. The permits required for this project include, but are not limited to, those stated below. The Contractor is responsible for preparing for and obtaining all permits required for this project. Each permitting application is associated with an approval lead time. Prior to starting the design contact each permitting agency to acquire the latest approval lead times and include this in the project design/construction schedule. This applies particularly to the Stormwater Management and Erosion and Sediment Control Permits.

6.16.1 Virginia Storm Water Management Permit

(a) Permitting Authority: State of Virginia, Department of Conservation and Recreation

(b) Type of Permit: VSMP Permit

(c) Permit Application Procedure: Submit proof of permit applications through the following offices at Fort Belvoir: Directorate of Public Works (DPW) and Environmental and Natural Resources Division (ENRD). Prepare the Storm Water Pollution Prevention Plan (SWPPP). Submit Notice of Intent, Inspection Reports, and Notice of Termination.

(d) Point of Contact: Dorothy Keough, Fort Belvoir Directorate of Public Works (DPW)/ENRD (703) 806-0049.

(e) Permit Fee: \$600.00

(f) Additional Information: The SWPPP shall conform to the Fort Belvoir MS4 Permit, the Fairfax County Facilities Manual, and the Virginia Erosion and Sediment Control Handbook. Fort Belvoir is the MS4 Permit holder and has final approval of the SWPPP submitted by the Contractor. The Contractor shall provide and maintain the SWPPP throughout the duration of the contract. Site work may not start until the SWPPP has been approved by Fort Belvoir.

#### 6.16.2 Erosion and Sedimentation Control Permit/Land Disturbance Letter

(a) Permitting Authority: Fort Belvoir DPW/ENRD

(a) Type of Permit: Erosion and Sedimentation Control Permit

(b) Permit Application Procedure: Submit Erosion and Sedimentation Control Plans and narrative to Fort Belvoir DPW/ENRD. The Erosion and Sedimentation Control Plans and narrative shall comply with the Fort Belvoir MS4 Permit, the Fairfax County Facilities Manual, and the Virginia Erosion and Sediment Control Handbook. Fort Belvoir shall review and approve the Erosion and Sedimentation Control Plans and narrative. This may be a three to four week process.

(c) Point of Contact: Dorothy Keough, Fort Belvoir Directorate of Public Works (DPW)/ENRD (703) 806-0049.

(d) Permit Fee: \$00.00

(e) Additional Information: Site work may not start until the Erosion and Sedimentation Control Plans and narrative have been approved by Fort Belvoir DPW/ENRD.

#### 6.16.3 Site Clearance Approval and Excavation Permit

(a) Permitting Authority: Fort Belvoir DPW

(b) Type of Permit: Site Clearance Approval and Excavation Permit

(c) Permit Application Procedure: Apply for Site Clearance Approval and Excavation (Digging) Permit

with the Fort Belvoir DPW.

(d) Point of Contact: Janet Lower, Fort Belvoir DPW (703) 806-3925.

(e) Permit Fee: Varies

(f) Additional Information: The Site Clearance Approval sets the limits of site disturbance. The Excavation Permit approval shall allow the existing utilities to be located in the field. The NPDES General Permit must be obtained before an Excavation Permit shall be issued.

#### 6.16.4 Sanitary Permit

(a) Permitting Authority: Virginia Department of Environmental Quality

(b) Type of Permit: Sanitary Sewer Permit

(c) Permit Application Procedure: Obtain initial sanitary sewer design approval from Fort Belvoir DPW.

Once approval is given, submit PE signed Sanitary Sewer Plans to Fort Belvoir DPW. Fort Belvoir DPW shall submit the Sanitary Sewer Permit Package to the Virginia Department of Environmental Quality.

(d) Point of Contact: Jim Eaton, Fort Belvoir DPW (703) 806-0060. The American Water POC is Mark Pietras at (571) 339-8085 or cell (571) 449-0832.

(e) Permit Fee: Varies

(f) Additional Information: Permit approval can vary up to 180 days, so early coordination is recommended. Approval is required prior to placing the system in service.

#### 6.16.5 Water Permit

(a) Permitting Authority: Virginia Department of Health

(b) Type of Permit: Waterworks Permit

(c) Permit Application Procedure: Obtain initial water service design approval from Fort Belvoir DPW.

Once approval is given, submit PE signed Water Service Plans to Fort Belvoir DPW. Fort Belvoir DPW shall submit the Waterworks Permit Package to the Virginia Department of Health.

(d) Point Contact: Jim Eaton, Fort Belvoir DPW (703) 806-0060.

(e) Permit Fee: Varies

(f) Additional Information: Permit approval can vary up to 180 days, so early coordination is recommended. Approval is required prior to placing the system in service.

#### 6.16.6 Wetland Permit

(a) Permitting Authority: Corps of Engineers

(b) Type of Permit: Wetland Permit

(c) Permit Application Procedure: Fort Belvoir DPW/ENRD shall delineate the wetlands and streams north of the project site. If the stormwater detention system outfall is not in the wetland or stream, a permit is not required. If the outfall is located within the wetland or stream, a wetland permit is required. The contractor shall provide Fort Belvoir DPW/ENRD with a completed design. The design must meet adequate outfall requirements as outlined in both state and county standards. Fort Belvoir DPW/ENRD shall prepare the Joint Permit Application (JPA) for the Wetland Permit and submit it to the Corps of Engineers.

(d) Point of Contact: Sybille Vega, Fort Belvoir DPW (703) 806-0048. The American Water POC is Mark Pietras at (571) 339-8085 or cell (571) 449-0832.

(e) Permit Fee: Varies

#### 6.16.7 Air Emission Permit

(a) Permitting Authority: Virginia Department of Environmental Quality

(b) Type of Permit: Air Emission Permit

(c) Permit Application Procedure: The contractor shall provide Fort Belvoir DPW/ENRD with technical information (cut sheets) for all air emission sources, such as boilers, generators, etc. Fort Belvoir shall fill out and send the Air Emission Permit application to the Virginia Department of Environmental Quality.

(d) Point of Contact: Kelly Lease, Fort Belvoir DPW/ENRD (703) 806-4008.

(e) Permit Fee: Varies

(f) Additional Information: It is anticipated the Air Emission Permit shall be required prior to start of construction.

#### 6.16.8 Fuel Storage Permit (If applicable to project)

(a) Permitting Authority: Fort Belvoir DPW and Virginia Department of Environmental Quality

(b) Type of Permit: Fuel Storage Permit

(c) Permit Application Procedure: The contractor shall fill out the Tank Activity Permit located in Appendix M. The Tank Activity Permit must be received by Fort Belvoir DPW/ENRD a minimum of 48 hours prior to tank installation. Fort Belvoir DPW/ENRD shall determine if the fuel storage tank needs to

be registered with the state.

(d) Point of Contact: Ben Wallen, Fort Belvoir DPW/ENRD (703) 806-3694.

(e) Permit Fee: Varies

(f) Additional Information: To avoid potential delays, submit Tank Activity Permit once type of fuel storage tank is determined in case storage tank is not acceptable on Fort Belvoir. This would allow time to find an acceptable alternative tank.

#### 6.16.9 State Historic Preservation Officer (SHPO)

(a) Permitting Authority: Fort Belvoir DPW and State Historic Preservation Officer

(b) Type of Permit: State Historic Preservation review

(c) Permit Application Procedure: The designer of Record shall contact Marcia Kicos, Fort Belvoir DPW/ENRD (703)-806-0020 for instructions.

(d) Point of Contact: Marcia Kicos, Fort Belvoir DPW/ERND (703) 806-0020.

(e) Permit Fee: None

(f) Additional Information: To avoid potential delays, submittal is required at various phases of design and each submittal shall require 30 days of review by SHPO plus 30 days by Fort Belvoir DPW. Contact **Marcia Kicos, Fort Belvoir DPW/ERND (703) 806-0020** for additional information and specific submittal requirements.

#### 6.16.10 National Capital Planning Commission (NCPC)

(a) Permitting Authority: Fort Belvoir DPW and National Capital Planning Commission

(b) Type of Permit: National Capital Planning Commission review

(c) Permit Application Procedure: The Designer of Record shall fill out the Project Review Application located in Appendix M. The Application and supporting documentation must be received and reviewed by Fort Belvoir DPW/ENRD at various stages of design. Fort Belvoir DPW/ENRD shall register with the commission.

(d) Point of Contact: The primary POC is Mr. Chris Landgraf at (703) 806-0043. The technical support during design is Mr. Richard Turner, Fort Belvoir DPW/ENRD (703) 806-3941.

(e) Permit Fee: No cost

(f) Additional Information: To avoid potential delays, the submission timeline must be keyed to NCPC's submission and review schedule shown on the NCPC website. Should the contractor miss the established

submission date(s) the follow-on Agency review will be pushed out another month. Deadlines for submission for projects requiring referral and those not requiring referral are shown on the NCPC website.

The NCPC has review authority over Belvoir projects and will require both a Preliminary and Final Submittal. The Preliminary submission is sent out for referral and takes 90 day for the preliminary referral submission, followed by proposed written responses to comments to the Government by the contractor. This in turn is followed by a final submission for 30 day review by the NCPC and must address all previous comments in coordination with the DPW's review. Total time normally 5 months. See the NCPC website for specific submission guidelines @ HYPERLINK "<http://www.ncpc.gov>" [www.ncpc.gov](http://www.ncpc.gov) . Over the shoulder reviews do not eliminate the NCPC submission. In addition, an early consultation meeting with NCPC should be included at around the 10% to 15% design stage. Review these requirements and timelines and schedule submittals accordingly.

#### 6.16.11 Hot-Work Permit

- (a) Permitting Authority: Fort Belvoir DES
- (b) Type of Permit: Hot-Work Permit
- (c) Permit Application Procedure: Complete DA Form 5383-R and submit to the Fort Belvoir DPW.
- (d) Point of Contact: Fort Belvoir Fire Department (703) 805-2091.
- (e) Permit Fee: None
- (f) Additional Information: The permit must be submitted to Fort Belvoir prior to using heat-producing equipment.

#### 6.16.12 Crane Registration

- (a) Permitting Authority: Fort Belvoir DPW
- (b) Type of Permit: Crane Registration
- (c) Permit Application Procedure: Register cranes used during construction for air traffic control.
- (d) Point of Contact: Dave Arroyo, Davison Army Air Field (DAAF), Operations, (703) 806-7054.
- (e) Permit Fee: None

#### 6.16.13 Site Utilization Plan (SUP)

- (a) Permitting Authority: Fort Belvoir DPW/ENRD
- (b) Type of Permit: Site Utilization Plan (SUP)
- (c) Permit Application Procedure: Provide plan showing location of temporary buildings or trailers used during construction and the location of permanent buildings.
- (d) Point of Contact: Chris Landgraf, Fort Belvoir DPW (703) 806-4641.

(e) Permit Fee: None

#### 6.16.16 Permit Fees

The contractor is responsible to pay for all required permits.

#### 6.17. DEMOLITION

The Contractor is responsible for site demolition shown on the Demolition Plan included in Appendix J. The Contractor shall remove all pavements, utilities, site features, trees, and structures necessary to construct the new Fire Station. Keep tree and vegetation removal to a minimum. All removed material shall be disposed outside the limits of Government controlled lands in accordance with Local, State, and Federal regulations. The Contractor shall notify the Contracting Officer's Representative if any material to be disposed of is found to contain hazardous, toxic, biological, or radiological substances.

#### 6.18. ADDITIONAL FACILITIES

No additional facilities

End of Section 01 10 00



**SECTION 01 32 01.00 10  
PROJECT SCHEDULE**

**1.0 GENERAL**

1.1. REFERENCES

1.2. QUALIFICATION

**2.0 PRODUCTS (NOT APPLICABLE)**

**3.0 EXECUTION**

3.1. GENERAL REQUIREMENTS

3.2. BASIS FOR PAYMENT AND COST LOADING

3.3. PROJECT SCHEDULE DETAILED REQUIREMENTS

3.4. PROJECT SCHEDULE SUBMISSIONS

3.5. SUBMISSION REQUIREMENTS

3.6. PERIODIC SCHEDULE UPDATE MEETINGS

3.7. REQUESTS FOR TIME EXTENSIONS

3.8. DIRECTED CHANGES

3.9. WEEKLY PROGRESS MEETINGS

3.10. OWNERSHIP OF FLOAT

3.11. TRANSFER OF SCHEDULE DATA INTO RMS/QCS

## **1.0 GENERAL**

### **1.1. REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE) ER 1-1-11 (1995) Progress, Schedules, and Network Analysis Systems (Available through the Publications page of the US Army Corps of Engineers TECHINFO Website at <http://www.hnd.usace.army.mil/techinfo/>. See link for Engineer Regulation ER 1-1-11).

### **1.2. QUALIFICATIONS**

Designate an authorized representative who shall be responsible for the preparation of the schedule and all required updating (statusing) and preparation of reports. The authorized representative shall be experienced in scheduling projects similar in nature to this project and shall be experienced in the use of the scheduling software that meets the requirements of this specification.

## **2.0 PRODUCTS (Not Applicable)**

## **3.0 EXECUTION**

### **3.1. GENERAL REQUIREMENTS**

3.1.1. Submit a project schedule as specified herein for approval showing the sequence in which the Contractor proposes to perform the work and dates on which the Contractor contemplates starting and completing all schedule activities. The scheduling of the entire project, including the design and construction sequences is required. Contractor management personnel shall actively participate in its development. Designers, subcontractors and suppliers working on the project shall also contribute in developing an accurate project schedule. The schedule must be a forward planning as well as a project monitoring tool. The approved project schedule shall be used to measure the progress of the work and to aid in evaluating requests for excusable time extensions. The schedule shall be cost loaded and activity coded as specified herein. The schedule will provide the basis for all progress payments. If the Contractor fails to submit any schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments until the Contractor submits the required schedule

3.1.2. Status the schedule on at least a monthly basis, as specified herein. If in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained. See paragraph 3.7.4.

3.1.3. Failure of the Contractor to comply with the requirements of the Contracting Officer shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of the contract.

### **3.2. BASIS FOR PAYMENT AND COST LOADING**

The schedule shall be the basis for determining contract earnings during each update period and therefore the amount of each progress payment. Lack of an approved schedule update or qualified

scheduling personnel will result in an inability of the Contracting Officer to evaluate contract earned value for the purposes of payment. Failure of the Contractor to provide all information, as specified herein will result in the disapproval of the preliminary, initial and subsequent schedule updates. In the event schedule revisions are directed by the Contracting Officer and those revisions have not been included in subsequent revisions or updates, the Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until such revisions to the project schedule have been made. Activity cost loading shall be reasonable as determined by the Contracting Officer. The aggregate value of all activities coded to a contract CLIN as specified herein shall equal the value of the CLIN on the Schedule.

### 3.3. PROJECT SCHEDULE DETAILED REQUIREMENTS

The computer software system utilized to produce and update the project schedule shall be capable of meeting all requirements of this specification. Failure of the Contractor to meet the requirements of this specification will result in the disapproval of the schedule. Scheduling software that meets the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER-1-1-11(1995) referenced herein are Primavera Project Planner (P3) by Primavera, and Open Plan by Deltek.

#### 3.3.1. Use of the Critical Path Method

Use the Critical Path Method (CPM) of network calculation to generate the project schedule. Prepare the project schedule using the Precedence Diagram Method (PDM).

#### 3.3.2. Level of Detail Required

Develop the project schedule to an appropriate level of detail. Failure to develop the project schedule to an appropriate level of detail, as determined by the Contracting Officer, will result in its disapproval. The Contracting Officer will consider, but is not limited to, the following characteristics and requirements to determine appropriate level of detail:

##### 3.3.2.1. Activity Durations

Reasonable activity durations are those that allow the progress of ongoing activities to be accurately determined between update periods. Less than 2 percent of all non-procurement activities shall have Original Durations (OD) greater than 20 work days or 30 calendar days. Procurement activities are defined herein.

##### 3.3.2.2. Design and Permit Activities

Include design and permit activities, including necessary conferences and follow-up actions and design package submission activities. Include the design schedule in the project schedule, showing the sequence of events involved in carrying out the project design tasks within the specific contract period. This shall be at a detailed level of scheduling sufficient to identify all major design tasks, including those that control the flow of work. Include review and correction periods associated with each item.

##### 3.3.2.3. Procurement Activities

Include activities associated with the submittal, approval, procurement, fabrication and delivery of long lead materials, equipment, fabricated assemblies and supplies. Long lead procurement activities are those with an anticipated procurement sequence of over 90 calendar days. A typical procurement sequence includes the string of activities: submit, approve/review, procure, fabricate, and deliver.

##### 3.3.2.4. Mandatory Tasks

Include and properly schedule the following tasks (See also the Sample Preliminary Submittal Register Input Form):

- (a) Submission, review and acceptance of design packages, including BIM
- (b) Submission of mechanical/electrical/information systems layout drawings
- (c) Submission and approval of O & M manuals
- (d) Submission and approval of as-built drawings
- (e) Submission and approval of 1354 data and installed equipment lists
- (f) Submission and approval of testing and air balance (TAB)
- (g) Submission of TAB specialist design review report
- (h) Submission and approval of fire protection specialist
- (i) Submission and approval of testing and balancing of HVAC plus commissioning plans and data. Develop the schedule logic associated with testing and commissioning of mechanical systems to a level of detail consistent with the contract commissioning requirements.
- (j) Air and water balancing
- (k) HVAC commissioning
- (l) Controls testing plan submission
- (m) Controls testing
- (n) Performance Verification testing
- (o) Other systems testing, if required
- (p) Contractor's pre-final inspection
- (q) Correction of punch list from Contractor's pre-final inspection
- (r) Government's pre-final inspection
- (s) Correction of punch list from Government's pre-final inspection
- (t) Final Inspection

3.3.2.5. Government Activities. Show Government and other agency activities that could impact progress. These activities include but are not limited to: approvals, design reviews, review conferences, release for construction of design package(s), environmental permit approvals by State regulators, inspections, utility tie-ins, Government Furnished Property/Equipment (GFP) and Notice to Proceed for phasing requirements, if any.

#### 3.3.2.6. Activity Responsibility Coding (RESP)

Assign Responsibility Code for all activities to the Prime Contractor, Subcontractor or Government agency responsible for performing the activity. Activities coded with a Government Responsibility code include, but are not limited to: Government approvals, Government design reviews, environmental permit approvals by State regulators, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements. Code all activities not coded with a Government Responsibility Code to the Prime Contractor or Subcontractor responsible to perform the work. Activities shall not have more than one Responsibility Code. Examples of acceptable activity code values are: DOR (for the designer of record); ELEC (for the electrical subcontractor); MECH (for the mechanical subcontractor); and GOVT (for USACE). Unacceptable code values are abbreviations of the names of subcontractors.

#### 3.3.2.7. Activity Work Area Coding (AREA)

Assign Work Area code to activities based upon the work area in which the activity occurs. Define work areas based on resource constraints or space constraints that would preclude a resource, such as a particular trade or craft work crew from working in more than one work area at a time due to restraints on

resources or space. Examples of Work Area Coding include different areas within a floor of a building, different floors within a building, and different buildings within a complex of buildings. Activities shall not have more than one Work Area Code. Not all activities are required to be Work Area coded. A lack of Work Area coding will indicate the activity is not resource or space constrained.

#### 3.3.2.8. Contract Changes/Requests for Equitable Adjustment (REA) Coding (MODF)

Assign Activity code to any activity or sequence of activities added to the schedule as a result of a Contract Modification, when approved by Contracting Officer, with a Contract Changes/REA Code. Key all Code values to the Government's modification numbering system. Any activity or sequence of activities added to the schedule as a result of alleged constructive changes made by the Government may be added to a copy of the current schedule, subject to the approval of the Contracting Officer. Assign Activity codes for these activities with a Contract Changes/REA Code. Key the code values to the Contractor's numbering system. Approval to add these activities does not necessarily mean the Government accepts responsibility and therefore liability for such activities and any associated impacts to the schedule, but rather the Government recognizes such activities are appropriately added to the schedule for the purposes of maintaining a realistic and meaningful schedule. Such activities shall not be Responsibility Coded to the Government unless approved. An activity shall not have more than one Contract Changes/REA Code

#### 3.3.2.9. Contract Line Item (CLIN) Coding (BIDI)

Code all activities to the CLIN on the Contract Line Item Schedule to which the activity belongs. An activity shall not contain more than one CLIN Item Code. CLIN Item code all activities, even when an activity is not cost loaded.

#### 3.3.2.10. Phase of Work Coding (PHAS)

Assign Phase of Work Code to all activities, based upon the phase of work in which the activity occurs. Code activities to either a Design Phase or a Construction Phase. Code fast track design and construction phases proposed by the Contractor to allow filtering and organizing the schedule by fast track design and construction packages. If the contract specifies construction phasing with separately defined performance periods, identify a Construction Phase Code to allow filtering and organizing the schedule accordingly. Each activity shall have only one Phase of Work code.

#### 3.3.2.11. Category of Work Coding (CATW)

Assign Category of Work code to all Activities based upon the category of work which the activity belongs. Category of Work Code must include, but is not limited to: Design, Design Submittal, design reviews, review conferences, Construction Submittal, Approvals (if any), Acceptance, Procurement, Fabrication, Delivery, Weather Sensitive Installation, Non-Weather Sensitive Installation, Start Up, Test, and Turnover. Assign a Category of Work code to each activity. Each activity shall have only one Category of Work Code.

#### 3.3.2.12. Definable Features of Work Coding (FOW1, FOW2, FOW3)

Assign a Definable Feature of Work Code to appropriate activities based on the definable feature of work to which the activity belongs. Definable Feature of Work is defined in Specification Section 01 45 04.00 10, Contractor Quality Control. An activity shall not have more than one Definable Feature of Work Code. Not all activities are required to be Definable Feature of Work Coded.

#### 3.3.3. Scheduled Project Completion and Activity Calendars

The schedule interval shall extend from NTP date to the required contract completion date. The contract completion activity (End Project) shall finish based on the required contract duration, as adjusted for any

approved contract time extensions. The first scheduled work period shall be the day after NTP is acknowledged by the Contractor. Schedule activities on a calendar to which the activity logically belongs. Activities may be assigned to a 7 day calendar when the contract assigns calendar day durations for the activity such as a Government Acceptance activity. If the Contractor intends to perform physical work less than seven days per week, schedule the associated activities on a calendar with non-work periods identified including weekends and holidays. Assign the Category of Work Code - Weather Sensitive Installation to those activities that are weather sensitive. Original durations must account for anticipated normal adverse weather. The Government will interpret all work periods not identified as non-work periods on each calendar as meaning the Contractor intends to perform work during those periods.

#### 3.3.3.1. Project Start Date

The schedule shall start no earlier than the date on which the NTP was acknowledged. Include as the first activity in the project schedule an activity called "Start Project" or "NTP". The "Start Project" activity shall have an "ES" constraint date equal to the date that the NTP was acknowledged, with a zero day duration.

#### 3.3.3.2. Schedule Constraints and Open Ended Logic

Constrain completion of the last activity in the schedule by the contract completion date. Schedule calculations shall result in negative float when the calculated early finish date of the last activity is later than the contract completion date. Include as the last activity in the project schedule an activity called "End Project". The "End Project" activity shall have an "LF" constraint date equal to the contract completion date for the project, and with a zero day duration or by using the "project must finish by" date in the scheduling software. The schedule shall have no constrained dates other than those specified in the contract. The use of artificial float constraints such as "zero free float" or "zero total float" are typically prohibited. There shall only be 2 open ended activities: Start Project (or NTP) with no predecessor logic and End Project with no successor logic.

#### 3.3.3.3. Early Project Completion

In the event the Preliminary or Initial project schedule calculates an early completion date of the last activity prior to the contract completion date, the Contractor shall identify those activities that it intends to accelerate and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. The last activity shall have a late finish constraint equal to the contract completion date and the schedule will calculate positive float. The Government will not approve an early completion schedule with zero float on the longest path. The Government is under no obligation to accelerate activities for which it is responsible to support a proposed early contract completion.

#### 3.3.4. Interim Completion Dates

Constrain contractually specified interim completion dates to show negative float when the calculated early finish date of the last activity in that phase is later than the specified interim completion date.

##### 3.3.4.1. Start Phase

Include as the first activity for a project phase an activity called "Start Phase X" where "X" refers to the phase of work. The "Start Phase X" activity shall have an "ES" constraint date equal to the date on which the NTP was acknowledged, and a zero day duration.

##### 3.3.4.2. End Phase

Include as the last activity for a project phase an activity called "End Phase X" where "X" refers to the phase of work. The "End Phase X" activity shall have an "LF" constraint date equal to the specified completion date for that phase and a zero day duration.

#### 3.3.4.3. Phase "X" Hammock

Include a hammock type activity for each project phase called "Phase X" where "X" refers to the phase of work. The "Phase X" hammock activity shall be logically tied to the earliest and latest activities in the phase.

#### 3.3.5. Default Progress Data Disallowed

Do not automatically update Actual Start and Finish dates with default mechanisms that may be included in the scheduling software. Activity Actual Start (AS) and Actual Finish (AF) dates assigned during the updating process shall match those dates provided from Contractor Quality Control Reports. Failure of the Contractor to document the AS and AF dates on the Daily Quality Control report for every in-progress or completed activity, and failure to ensure that the data contained on the Daily Quality Control reports is the sole basis for schedule updating shall result in the disapproval of the Contractor's updated schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. Updating of the percent complete and the remaining duration of any activity shall be independent functions. Disable program features which calculate one of these parameters from the other.

#### 3.3.6. Out-of-Sequence Progress

Activities that have progressed before all preceding logic has been satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case basis subject to approval by the Contracting Officer. Propose logic corrections to eliminate all out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule..

#### 3.3.7. Negative Lags and Start to Finish Relationships

Lag durations contained in the project schedule shall not have a negative value. Do not use Start to Finish relationships (SF).

#### 3.3.8. Calculation Mode

Schedule calculations shall retain the logic between predecessors and successors even when the successor activity starts and the predecessor activity has not finished. Software features that in effect sever the tie between predecessor and successor activities when the successor has started and the predecessor logic is not satisfied ("progress override") will not be allowed.

#### 3.3.9. Milestones

Include milestone activities for each significant project event including but not limited to: milestone activities for each fast track design package released for construction; design complete; foundation/substructure construction complete; superstructure construction complete; building dry-in or enclosure complete to allow the initiation of finish activities; permanent power complete; and building systems commissioning complete.

#### 3.3.10. Use of Primavera "P6"

If P6 is being used, the following settings are mandatory in the Preliminary Project Schedule, Initial Project Schedule and all schedule submissions to the Government:

- 3.3.10.1. Activity Codes shall be Project Level not Global or EPS level.
- 3.3.10.2. Calendars shall be Project Level not Global or Resource level.
- 3.3.10.3. Set Activity Duration Types to "Fixed Duration & Units".

- 3.3.10.4. Set Percent Complete Types to "Physical".
- 3.3.10.5. Use Default Time Period Admin Preferences "8.0 hr/day, 40 hr/week, 172 hr/month, 2000 hr/year". Set Calendar Work Hours/Day to 8.0 Hour days. This is not to mandate the Contractor's work week. Alternate workweeks may be set up in "Calendar Settings".
- 3.3.10.6. Set Schedule Option for defining Critical Activities "Longest Path".
- 3.3.10.7. Set Schedule Option for defining progressed activities "Retained Logic".
- 3.3.10.8. Set up Cost loading a single lump sum Resource. The Price/Unit shall be \$1/hr, Default Units/Time shall be "8h/d", and select settings "Auto Compute Actuals" and "Calculate costs from units".
- 3.3.10.9. Activity ID's shall not exceed 10 characters.
- 3.3.10.10. Activity Names shall have the most defining and detailed description within the first 30 characters.

### 3.4. PROJECT SCHEDULE SUBMISSIONS

Provide the submissions as described below. The data CD, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS.

#### 3.4.1. Preliminary Project Schedule Submission

Submit the Preliminary Project Schedule, defining the Contractor's planned operations for the first 90 calendar days for approval within 15 calendar days after the NTP is acknowledged. The approved Preliminary Project Schedule will be used for payment purposes not to exceed 90 calendar days after NTP. Completely cost load the Preliminary Project Schedule to balance the contract award CLINS shown on the Price Schedule. Detail it for the first 90 calendar days. It may be summary in nature for the remaining performance period. It must be early start and late finish constrained and logically tied as previously specified. The Preliminary Project Schedule forms the basis for the Initial Project Schedule specified herein and must include all of the required Plan and Program preparations, submissions and approvals identified in the contract (for example, Quality Control Plan, Safety Plan, and Environmental Protection Plan) as well as design activities, the planned submissions of all early design packages, permitting activities, design review conference activities and other non-construction activities intended to occur within the first 90 calendar days. Schedule any construction activities planned for the first 90 calendar days after NTP. Constrain planned construction activities by Government acceptance of the associated design package(s) and all other specified Program and Plan approvals. Activity code any activities that are summary in nature after the first 90 calendar days with Responsibility Code (RESP) and Feature of Work code (FOW1, FOW2, FOW3)

#### 3.4.2. Initial Project Schedule Submission

Submit the Initial Project Schedule for approval within 42 calendar days after NTP. The schedule shall demonstrate a reasonable and realistic sequence of activities which represent all work through the entire contract performance period. The Initial Schedule shall be at a reasonable level of detail as determined by the Contracting Officer. Include detailed design and permitting activities, including but not limited to identification of individual design packages, design submission, reviews and conferences; permit submissions and any required Government actions; and long lead procurement activities required prior to design completion. The Initial Project Schedule shall include the entire construction sequence and all fast track construction activities, with as much detail as is known at the time but, as a minimum, shall include all construction start and completion milestone activities, and detailed construction activities through the dry-in milestone, including all activity coding and cost loading. Include the remaining construction, including cost loading, but it may be scheduled summary in nature. As the design proceeds and design



packages are developed, fully detail the remaining construction activities concurrent with the monthly schedule updating process. Constrain construction activities by Government acceptance of associated designs. When the design is complete, incorporate into the then approved schedule update all remaining detailed construction activities that are planned to occur after the dry-in milestone.

### 3.4.3. Design Package Schedule Submission:

With each design package submitted to the Government, submit a frag-net schedule extracted from the then current Preliminary, Initial or Updated schedule which covers the activities associated with that Design Package including construction, procurement and permitting activities.

### 3.4.4. Periodic Schedule Updates

Based on the result of the meeting specified in PERIODIC SCHEDULE UPDATE MEETINGS, submit periodic schedule updates. These submissions shall enable the Contracting Officer to assess Contractor's progress. If the Contractor fails or refuses to furnish the information and project schedule data, which in the judgment of the Contracting Officer or authorized representative is necessary for verifying the Contractor's progress, the Contractor shall be deemed not to have provided an estimate upon which progress payment may be made. Update the schedule to include detailed lower WBS activities procurement and construction activities as the design progresses, but not later than the submission of the final, un-reviewed design submission for each separate design package. The Contracting Officer may require submission of detailed schedule activities for any distinct construction that is started prior to submission of a final design submission, if such activity is authorized.

### 3.4.5. Standard Activity Coding Dictionary

Use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11, Appendix A. This exact structure is mandatory, even if some fields are not used. A template SDEF compatible schedule backup file (sdef.prx) is available on the QCS website: <http://rms.usace.army.mil>.

The SDEF format is as follows:

Field	Activity Code	Length	Description
1	WRKP	3	Workers per Day
2	RESP	4	Responsible Party (e.g. GC, subcontractor, USACE)
3	AREA	4	Area of Work
4	MODF	6	Modification or REA number
5	BIDI	6	Bid Item (CLIN)
6	PHAS	2	Phase of Work
7	CATW	1	Category of Work
8	FOW1	10	Feature of Work (used up to 10 characters in length)

9	FOW2	10	Feature of Work (used up to 20 characters in length)
10	FOW3	10	Feature of Work (used up to 30 characters in length)

### 3.5. SUBMISSION REQUIREMENTS

Submit the following items for the Preliminary Schedule, Initial Schedule, and every Periodic Schedule Update throughout the life of the project:

#### 3.5.1. Data CD's

Provide two sets of data CD's containing the project schedule in the backup format. Each CD shall also contain all previous update backup files. File medium shall be CD. Label each CD, indicating the type of schedule (Preliminary, Initial, Update), full contract number, Data Date and file names. Each schedule shall have a unique file name as determined by the Contractor.

#### 3.5.2. Narrative Report

Provide a Narrative Report with the Preliminary, Initial, and each Periodic Update of the project schedule, as the basis of the progress payment request. The Narrative Report shall include: a description of activities along the 2 most critical paths where the total float is less than or equal to 20 work days, a description of current and anticipated problem areas or delaying factors and their impact, and an explanation of corrective actions taken or required to be taken. The narrative report is expected to communicate to the Government, the Contractor's thorough analysis of the schedule output and its plans to compensate for any problems, either current or potential, which are revealed through its analysis. Identify and explain why any activities that, based their calculated late dates, should have either started or finished during the update period but did not.

#### 3.5.3. Approved Changes Verification

Include only those project schedule changes in the schedule submission that have been previously approved by the Contracting Officer. The Narrative Report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

#### 3.5.4. Schedule Reports

The format, filtering, organizing and sorting for each schedule report shall be as directed by the Contracting Officer. Typically reports shall contain: Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date Total Float, Actual Start Date, Actual Finish Date, and Percent Complete. The following lists typical reports that will be requested. One or all of these reports may be requested for each schedule submission.

##### 3.5.4.1. Activity Report

A list of all activities sorted according to activity number.

##### 3.5.4.2. Logic Report

A list of detailed predecessor and successor activities for every activity in ascending order sorted by activity number.

##### 3.5.4.3. Total Float Report

A list of all incomplete activities sorted in ascending order of total float. List activities which have the same amount of total float in ascending order of Early Start Dates. Do not show completed activities on this report.

#### 3.5.4.4. Earnings Report by CLIN

A compilation of the Contractor's Total Earnings on the project from the NTP to the data date. This report shall reflect the earnings of specific activities based on the agreements made in the schedule update meeting defined herein. Provided that the Contractor has provided a complete schedule update, this report shall serve as the basis of determining progress payments. Group activities by CLIN Item number and sort by activity number. This report shall: sum all activities coded to a particular CLIN and provide a CLIN Item percent earned value; and complete and sum CLIN items to provide a total project percent complete. The printed report shall contain, for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Quantity to Date, Percent Complete (based on cost), and Earnings to Date.

#### 3.5.5. Network Diagram

The network diagram is required for the Preliminary, Initial and Periodic Updates. Depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

##### 3.5.5.1. Continuous Flow

Show a continuous flow from left to right with no arrows from right to left. Show the activity number, description, duration, and estimated earned value on the diagram.

##### 3.5.5.2. Project Milestone Dates

Show dates on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

##### 3.5.5.3. Critical Path

Clearly show the critical path.

##### 3.5.5.4. Banding

Organize activities as directed to assist in the understanding of the activity sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

##### 3.5.5.5. S-Curves

Earnings curves showing projected early and late earnings and earnings to date.

#### 3.6. PERIODIC SCHEDULE UPDATE MEETINGS

Conduct periodic schedule update meetings for the purposes of reviewing the Contractor's proposed out of sequence corrections, determining causes for delay, correcting logic, maintaining schedule accuracy and determining earned value. Meetings shall occur at least monthly within five days of the proposed schedule data date and after the Contractor has updated the schedule with Government concurrence respecting actual start dates, actual finish dates, remaining durations and percent complete for each activity it intend to status. Match the actual start and finish dates with the dates exported, as described in paragraph 3.3.5. Provide a computer with the scheduling software loaded and a projector during the meeting which allows all meeting participants to view the proposed schedule update during the meeting.

The meeting and resultant approvable schedule update shall be a condition precedent to a formal submission of the update as described in SUBMISSION REQUIREMENTS and to the submission of an invoice for payment. The meeting will be a working interactive exchange which will allow the Government and the Contractor the opportunity review the updated schedule on a real time and interactive basis. The Contractor's authorized scheduling representative will organize, sort, filter and schedule the update as requested by the Government. The meeting will last no longer than 8 hours. A rough draft of the proposed activity logic corrections and narrative report shall be provided to the Government 48 hours in advance of the meeting. The Contractor's Project Manager and Authorized Scheduler shall attend the meeting with the Authorized Representative of the Contracting Officer.

#### 3.6.1. Update Submission Following Progress Meeting

Submit a complete update of the project schedule containing all approved progress, revisions, and adjustments, pursuant to paragraph SUBMISSION REQUIREMENTS not later than 4 working days after the periodic schedule update meeting, reflecting only those changes made during the previous update meeting.

#### 3.6.2. Status of Activities

Update statusing information, including Actual Start Dates (AS), Actual Finish Dates (AF), Remaining Durations (RD) and Percent Complete shall be subject to the approval of the Government prior to the meeting. As a minimum, address the following items on an activity by activity basis during each progress meeting:

##### 3.6.2.1. Actual Start and Finish Dates

Accurately status the AS and/or AF dates for each activity currently in-progress or completed since the last update. The Government may allow an AF date to be assigned with the percent complete less than 100% to account for the value of work remaining but not restraining successor activities. Only assign AS dates when actual progress occurs on an activity.

##### 3.6.2.2. Remaining Duration

Update the estimated RD for all incomplete activities independent of Percent Complete. Remaining durations may exceed the activity OD or may exceed the activity's prior update RD if the Government considers the current OD or RD to be understated based on current progress, insufficient work crews actually manning the job, unrealistic OD or deficiencies that must be corrected that restrain successor activities.

##### 3.6.2.3. Percent Complete

Update the percent complete for each activity started based on the realistic assessment of earned value. Activities which are complete but for remaining minor punch list work and which do not restrain the initiation of successor activities may be statused 100 percent complete. To allow for proper schedule management, cost load the correction of punch list from Government pre-final inspection activity(ies) not less than 1% of the total contract value, which activity(ies) may be declared 100 percent complete upon completion and correction of all punch list work identified during Government pre-final inspection(s).

##### 3.6.2.4. Logic Changes

Specifically identify and discuss all logic changes pertaining to NTP on change orders, change orders to be incorporated into the schedule, contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, and other changes that have been made pursuant to contract provisions. The Government will only approve logic revisions for the purpose of keeping the

schedule valid in terms of its usefulness in calculating a realistic completion date, correcting erroneous logic ties, and accurately sequencing the work.

#### 3.6.2.5. Other Changes

Other changes required due to delays in completion of any activity or group of activities include: 1) delays beyond the Contractor's control, such as strikes and unusual weather. 2) delays encountered due to submittals, Government Activities, deliveries or work stoppages which make re-planning the work necessary. 3) Changes required to correct a schedule that does not represent the actual or planned prosecution and progress of the work.

### 3.7. REQUESTS FOR TIME EXTENSIONS

In the event the Contractor believes it is entitled to an extension of the contract performance period, completion date, or any interim milestone date, furnish the following for a determination by the Contracting Officer: justification, project schedule data, and supporting evidence as the Contracting Officer may deem necessary. Submission of proof of excusable delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is a condition precedent to any approvals by the Government. In response to each Request For Proposal issued by the Government, the Contractor shall submit a schedule impact analysis demonstrating whether or not the change contemplated by the Government impacts the critical path.

#### 3.7.1. Justification of Delay

The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involved with its request. The Contracting Officer's determination as to the number of allowable days of contract extension shall be based upon the project schedule updates in effect for the time period in question, and other factual information.

Actual delays that are found to be caused by the Contractor's own actions, which result in a calculated schedule delay, will not be a cause for an extension to the performance period, completion date, or any interim milestone date.

#### 3.7.2. Submission Requirements

Submit a justification for each request for a change in the contract completion date of less than 2 weeks based upon the most recent schedule update at the time of the NTP or constructive direction issued for the change. Such a request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum:

3.7.2.1. A list of affected activities, with their associated project schedule activity number.

3.7.2.2. A brief explanation of the causes of the change

3.7.2.3. An analysis of the overall impact of the changes proposed.

3.7.2.4. A sub-network of the affected area

Identify activities impacted in each justification for change by a unique activity code contained in the required data file.

#### 3.7.3. Additional Submission Requirements

The Contracting Officer may request an interim update with revised activities for any requested time extension of over 2 weeks. Provide this disk within 4 days of the Contracting Officer's request.

### 3.7.4. If Progress Falls Behind the Approved Project Schedule

3.7.4.1. Should progress fall behind the approved schedule (more than 20 work days of negative float) due to Contractor generated problems, promptly provide a supplemental recovery or completion schedule that illustrates its efforts to regain time to assure a completion by the required contract completion date.

3.7.4.2. The supplemental recovery or completion schedule will not replace the original, approved schedule as the official contract schedule. Continue to update the original, approved schedule on at least a monthly basis. In addition, the Contractor and the Contracting Officer will monitor the supplemental recovery or completion schedule on at least a bi-weekly basis to determine its effect on regaining the rate of progress to assure project completion by the contractually required completion date.

3.7.4.3. Do not artificially improve progress by simply revising the schedule logic, modifying or adding constraints, or shortening future work activity durations. Resource and manpower load the supplemental recovery schedule or completion schedule with crew size and productivity for each remaining activity, indicating overtime, weekend work, and/or double shifts needed to regain the schedule, in accordance with FAR 52.236.15, without additional cost to the Government. Indicate assumptions made and the basis for any logic, constraint, or duration changes used in the creation of the supplemental recovery or completion schedule in a narrative submitted for the Contracting Officer's approval. Any additional resources or manpower must be evident at the work site. Do not modify the official contract schedule to include these assumptions.

3.7.4.4. Failure to perform work and maintain progress in accordance with the supplemental recovery or completion schedule may result in an interim and final unsatisfactory performance rating and/or may result in corrective action by the Contracting Officer in accordance with FAR 52.236-15.

### 3.8. DIRECTED CHANGES

If the NTP is issued for changes prior to settlement of price and/or time, submit proposed schedule revisions to the Contracting Officer within 2 weeks of the NTP being issued. The Contracting Officer will approve proposed revisions to the schedule prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revisions, the Contracting Officer may furnish the Contractor with suggested revisions to the project schedule. The Contractor shall include these revisions in the project schedule until revisions are submitted and final changes and impacts have been negotiated. If the Contractor has any objections to the revisions furnished by the Contracting Officer, advise the Contracting Officer within 2 weeks of receipt of the revisions. Regardless of the objections, the Contractor shall continue to update the schedule with the Contracting Officer's revisions until a mutual agreement in the revisions is reached. If the Contractor fails to submit alternative revisions within 2 weeks of receipt of the Contracting Officer's proposed revisions, the Contractor will be deemed to have concurred with the Contracting Officer's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work.

### 3.9. WEEKLY PROGRESS MEETINGS

3.9.1. The Government and the Contractor shall meet weekly (or as otherwise mutually agreed to) between the meetings described in paragraph PERIODIC SCHEDULE UPDATE MEETINGS for the purpose of jointly reviewing the actual progress of the project as compared to the as planned progress and to review planned activities for the upcoming two weeks. The then current and approved schedule update shall be used for the purposes of this meeting and for the production and review of reports. The Contractor's Project Manager and the Authorized Representative of the Contracting Officer shall attend. The weekly progress meeting will address the status of RFI's, RFP's and Submittals.

3.9.2. Provide a bar chart produced by the scheduling software, organized by Total Float and Sorted by Early Start Date, and a two week "look-ahead" schedule by filtering all schedule activities to show only

current ongoing activities and activities schedule to start during the upcoming two weeks, organized by Work Area Code (AREA) and sorted by Early Start Date.

3.9.3. The Government and the Contractor shall jointly review the reports. If it appears that activities on the longest path(s) which are currently driving the calculated completion date (driving activities), are not progressing satisfactorily and therefore could jeopardize timely project completion, corrective action must be taken immediately. Corrective action includes but is not limited to: increasing the number of work crews; increasing the number of work shifts; increasing the number of hours worked per shift; and determining if Government responsibility coded activities require Government corrective action.

### 3.10. OWNERSHIP OF FLOAT

Float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor.

### 3.11. TRANSFER OF SCHEDULE DATA INTO RMS/QCS

Download and upload the schedule data into the Resident Management System (RMS) prior to RMS databases being transferred to the Government and is considered to be additional supporting data in a form and detail required by the Contracting Officer pursuant to FAR 52.232-5 - Payments under Fixed-Price Construction Contracts. The receipt of a proper payment request pursuant to FAR 52.232-27 - Prompt Payment for Construction Contracts is contingent upon the Government receiving both acceptable and approvable hard copies and electronic export from QCS of the application for progress payment.

End of Section 01 32 01.00 10

**SECTION 01 33 00  
SUBMITTAL PROCEDURES**

**1.0 GENERAL**

- 1.1. DEFINITIONS
- 1.2. NOT USED
- 1.3. SUBMITTAL CLASSIFICATION
- 1.4. APPROVED OR CONCURRED WITH SUBMITTALS
- 1.5. DISAPPROVED SUBMITTALS
- 1.6. WITHHOLDING OF PAYMENT
- 1.7. GENERAL
- 1.8. SUBMITTAL REGISTER
- 1.9. SCHEDULING
- 1.10. TRANSMITTAL FORM (ENG FORM 4025)
- 1.11. SUBMITTAL PROCEDURES
- 1.12. CONTROL OF SUBMITTALS
- 1.13. GOVERNMENT APPROVED SUBMITTALS
- 1.14. INFORMATION ONLY SUBMITTALS
- 1.15. STAMPS



## 1.0 GENERAL

### 1.1. DEFINITIONS

#### 1.1.1. Submittal

Contract Clauses "FAR 52.236-5, Material and Workmanship," paragraph (b) and "FAR 52.236-21, Specifications and Drawings for Construction," paragraphs (d), (e), and (f) apply to all "submittals."

#### 1.1.2. Submittal Descriptions (SD)

Submittals requirements are specified in the technical sections. Submittals are identified by SD numbers and titles as follows.

##### SD-01 Preconstruction Submittals

- Certificates of insurance.
- Surety bonds.
- List of proposed subcontractors.
- List of proposed products.
- Construction Progress Schedule.
- Submittal register.
- Schedule of prices.
- Accident Prevention Plan.
- Work plan.
- Quality control plan.
- Environmental protection plan.

##### SD-02 Shop Drawings

- Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.
- Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.
- Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

##### SD-03 Product Data

- Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials or equipment for some portion of the work.
- Samples of warranty language when the contract requires extended product warranties.

##### SD-04 Samples

- Physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.
- Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.
- Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies that are to be incorporated into the project and those which will be removed at conclusion of the work.

##### SD-05 Design Data

- Calculations, mix designs, analyses or other data pertaining to a part of work.
- Design submittals, design substantiation submittals and extensions of design submittals.

#### SD-06 Test Reports

- Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must have been within three years of date of contract award for the project.)
- Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.
- Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.
- Investigation reports.
- Daily checklists.
- Final acceptance test and operational test procedure.

#### SD-07 Certificates

- Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.
- Document required of Contractor, or of a supplier, installer or subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.
- Confined space entry permits.
- Text of posted operating instructions.

#### SD-08 Manufacturer's Instructions

- Preprinted material describing installation of a product, system or material, including special notices and Material Safety Data sheets concerning impedances, hazards and safety precautions.

#### SD-09 Manufacturer's Field Reports

- Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- Factory test reports.

#### SD-10 Operation and Maintenance Data

- Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

#### SD-11 Closeout Submittals

- Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

##### 1.1.3. Approving Authority

Office authorized to approve submittal.

##### 1.1.4. Work

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

##### 1.2. NOT USED

### 1.3. SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

#### 1.3.1. Designer of Record Approved (DA)

1.3.1.1. Designer of Record (DOR) approval is required for all extensions of design, critical materials, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction", they are considered to be "shop drawings". Provide the Government the number of copies designated hereinafter of all DOR approved submittals, after the DOR has taken appropriate action. The DOR shall ensure that submittals conform to the Solicitation, the Accepted Proposal and the completed design, however see below for those submittals proposing a deviation to the contract or a substitution of a material, system, or piece of equipment that was identified by manufacturer, brand name or model description in the accepted contract proposal.

1.3.1.2. The DOR shall ensure that the submittals comply with all applicable Buy American Act and Trade Agreement Act clauses in the contract. The DOR may confer with the Contracting Officer's Representative for advice and interpretation of those clauses, as necessary.

1.3.1.3. The Government may, but is not required to, review any or all DOR approved submittals for conformance to the solicitation, accepted proposal and the completed design. Except for submittals designated as deviating from the Solicitation, the Accepted Proposal or completed design, the Contractor may proceed with acquisition and installation upon DOR approval. Government Approved (GA)

#### 1.3.2. Government Approved (GA)

Government approval is required for any item specifically designated as requiring Government approval in the Solicitation, for internal and external color finish selections and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

#### 1.3.3. Government Conformance Review of Design (CR)

The Government will review all intermediate and final design submittals for conformance with the technical requirements of the solicitation. Section 01 33 16 **DESIGN AFTER AWARD** covers the design submittal and review process in detail. Review will be only for conformance with the applicable codes, standards and contract requirements. Design data includes the design documents described in Section 01 33 16 **DESIGN AFTER AWARD**. Generally, design submittals should be identified as SD-05 Design Data submittals.

#### 1.3.4. Designer of Record Approved/Government Conformance Review (DA/CR)

1.3.4.1. Deviations to the Accepted Design. Designer of Record approval and the Government's concurrence are required for any proposed deviation from the accepted design which still complies with the contract (the Solicitation and Accepted Proposal) before the Contractor is authorized to proceed with material acquisition or installation. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction", they are considered to be "shop drawings." If necessary to facilitate the project schedule, the Contractor and the DOR may discuss a submittal proposing a deviation with the Contracting Officer's Representative prior to officially submitting it to the Government. However, the Government reserves the right to review the submittal before providing an opinion, if it deems it necessary. In any case, the Government will not formally agree to or provide a preliminary opinion on any deviation without the DOR's approval or recommended approval. The Government reserves the right to non-concur with any deviation from the design, which may impact furniture, furnishings, equipment selections or operations decisions that were made, based on the reviewed and concurred design.

1.3.4.2. Substitutions. Unless prohibited or provided for otherwise elsewhere in the Contract, where the accepted contract proposal named products, systems, materials or equipment by manufacturer, brand name and/or by model number or other specific identification, and the Contractor desires to substitute manufacturer or model after award, submit a requested substitution for Government concurrence. Include substantiation, identifying information and the DOR's approval, as meeting the contract requirements and that it is equal in function, performance, quality and salient features to that in the accepted contract proposal.

#### 1.3.5. Designer of Record Approved/Government Approved (DA/GA)

Any proposed deviation to the solicitation and/or the accepted proposal constitutes a change to the contract. In addition to the above stated requirements for proposed deviations to the accepted design, both Designer of Record and Government Approval and, where applicable, a contract modification are required before the Contractor is authorized to proceed with material acquisition or installation for any proposed deviation to the contract. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction", they are considered to be "shop drawings". The Government reserves the right to accept or reject any such proposed deviation at its discretion.

#### 1.3.6. Information Only

All submittals not requiring Designer of Record or Government approval will be for information only. Provide the Government "For Information Only" copies of all submittals not requiring Government approval or concurrence, after the Designer of Record has taken the appropriate action.

#### 1.4. APPROVED OR CONCURRED WITH SUBMITTALS

Do not construe the Contracting Officer's approval of or concurrence with submittals as a complete check, but only that design, general method of construction, materials, detailing and other information appear to meet the Solicitation and Accepted Proposal. Approval or concurrence will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for design, dimensions, all design extensions, such as the design of adequate connections and details, etc., and the satisfactory construction of all work. The Government won't consider re-submittals for the purpose of substituting previously approved materials or equipment unless accompanied by an explanation of why a substitution is necessary.

#### 1.5. DISAPPROVED SUBMITTALS

Make all corrections required by the Contracting Officer, obtain the Designer of Record's approval when applicable, and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. Resubmit any "information only" submittal found to contain errors or unapproved deviations from the Solicitation or Accepted Proposal as one requiring "approval" action, requiring both Designer of Record and Government approval. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, provide prompt notice in accordance with the Contract Clause "Changes" to the Contracting Officer.

#### 1.6. WITHHOLDING OF PAYMENT

No payment for materials incorporated in the work will be made if all required Designer of Record or required Government approvals have not been obtained. No payment will be made for any materials incorporated into the work for any conformance review submittals or information only submittals found to contain errors or deviations from the Solicitation or Accepted Proposal.

#### 1.7. GENERAL

Make submittals as required by the specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, the Contractor's Quality Control (CQC) System Manager and the Designer of Record, if applicable, shall check, approve, sign, and stamp all items, indicating action taken. Clearly identify proposed deviations from the contract requirements. Include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Schedule and make submittals requiring Government approval prior to the acquisition of the material or equipment covered thereby. Pick up and dispose of samples remaining upon completion of the work in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

#### 1.8. SUBMITTAL REGISTER (GA)

Develop a complete list of submittals, including each separate design package submittal. Submit the initial submittal register within 15 days after Notice to Proceed, including, as a minimum, the design packages and other initial submittals required elsewhere in the contract. The Designer of Record shall identify required submittals in the specifications, and use the list to prepare the Submittal Register, utilizing the government-provided software, QCS (see Section 01 45 01.10), to create the ENG Form 4288. Appendix R is a preliminary submittal register input form for use with the Quality Management System and the Resident Office Management System (QCS and RMS). The Government will provide the Contractor the actual Excel Spreadsheet version of this sample input form after award to modify and to use for input into QCS. The Excel Spreadsheet is not totally inputable into QCS, so additional keystroke input will be necessary. The sample input form is not all-inclusive. In addition, additional submittals may be required by other parts of the contract. After award, the parties will meet to discuss contract specific (or task order specific for a task order contract) distribution for the submittals all-inclusive and additional submittals may be required by other parts of the contract. Develop and complete the submittal register as the design is completed. Submit it to the Contracting Officer with the un-reviewed final design package submission or as soon as the design specifications are completed, if before the final design submission. When applicable, if the Contractor elects to fast track design and construction, using multiple design package submissions, update the submittal register to reflect the submittals associated with each design submission, clearly denoting all revisions to the previous submission. The submittal register serves as a scheduling document for submittals and for control of submittal actions throughout the contract period. Coordinate the submit dates and need dates used in the submittal register with dates in the Contractor prepared progress schedule. Submit monthly updates to the submittal register showing the Contractor action codes and actual dates with Government action codes and actual dates or until all submittals have been satisfactorily completed. Revise and submit the submittal register when revising the progress schedule.

#### 1.9. SCHEDULING

Schedule submittals covering component items forming a system or items that are interrelated to be coordinated and submitted concurrently. Schedule certifications to be submitted with the pertinent drawings. Allow adequate time (a minimum of 15 calendar days exclusive of mailing time) and show on the register for those items requiring Government approval or concurrence. No delay damages or time extensions will be allowed for time lost in late submittals by the Contractor.

#### 1.10. TRANSMITTAL FORM (ENG FORM 4025)

Use the transmittal form (ENG Form 4025) for submitting submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor or are included in the QCS software if the Contractor is required to use QCS for this contract. Use a separate transmittal form for each specification section. Complete this form by filling out all the heading blank spaces and identify

each item submitted. Exercise special care to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

#### 1.11. SUBMITTAL PROCEDURES

Make submittals as follows:

##### 1.11.1. Procedures

The Government will further discuss detailed submittal procedures with the Contractor at the Post-Award Conference.

##### 1.11.2. Deviations

For submittals which include proposed deviations requested by the Contractor, check the column "variation" of ENG Form 4025. Set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

#### 1.12. CONTROL OF SUBMITTALS

Carefully control his procurement operations to ensure that each individual submittal is made on or before the scheduled submittal date shown on the approved "Submittal Register."

#### 1.13. GOVERNMENT APPROVED OR CONCURRED WITH SUBMITTALS

Upon completion of review of submittals requiring Government approval or concurrence, the Government will stamp and date the submittals as approved or concurred.. The Government will retain two (2) copies of the submittal and return one (1) copy(ies) of the submittal.

#### 1.14. INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe. The Government will retain two (2) copies of information only submittals.

#### 1.15. STAMPS

Use stamps similar to the following on the submittal data to certify that the submittal meets contract requirements:

CONTRACTOR

(FIRM NAME)

\_\_\_\_\_  
Approved

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Approved with corrections as noted on submittal data and/or attached  
sheet(s)

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Signature:

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Title:

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Date:

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**For design-build construction, both the Contractor Quality Control System Manager and the Designer of Record shall stamp and sign to certify that the submittal meets contract requirements.**

**SECTION 01 33 16  
DESIGN AFTER AWARD**

**1.0 GENERAL INFORMATION**

1.1. INTRODUCTION

1.2. DESIGNER OF RECORD

**2.0 PRODUCTS (Not Applicable)**

**3.0 EXECUTION**

3.1. PRE-WORK ACTIVITIES & CONFERENCES

3.1.1. Design Quality Control Plan

3.1.2. Post Award Conference

3.1.3. Partnering & Project Progress Processes

3.1.4. Initial Design Conference

3.1.5. Pre-Construction Conference

3.2. STAGES OF DESIGN SUBMITTALS AND OVER THE SHOULDER PROGRESS REVIEWS

3.2.1. Site/Utilities

3.2.2. Interim Design Submittals

3.2.3. Over-the-Shoulder Progress Reviews

3.2.4. Final Design Submissions

3.2.5. Design Complete Submittals

3.2.6. Holiday Periods for Government Review or Actions

3.2.7. Late Submittals and Reviews

3.3. DESIGN CONFIGURATION MANAGEMENT

3.3.1. Procedures

3.3.2. Tracking Design Review Comments

3.3.3. Design and Code Checklists

3.4. INTERIM DESIGN REVIEWS AND CONFERENCES

3.4.1. General

3.4.2. Procedures



- 3.4.3. Conference Documentation
- 3.5. INTERIM DESIGN REQUIREMENTS
  - 3.5.1. Drawings
  - 3.5.2. Design Analyses
  - 3.5.3. Geotechnical Investigations and Reports
  - 3.5.4. LEED Documentation
  - 3.5.5. Energy Conservation
  - 3.5.6. Specifications
  - 3.5.7. Building Rendering
  - 3.5.8. Interim Building Design Contents
- 3.6. FINAL DESIGN REVIEWS AND CONFERENCES
- 3.7. FINAL DESIGN REQUIREMENTS
  - 3.7.1. Drawings
  - 3.7.2. Design Analysis
  - 3.7.3. Specifications
  - 3.7.4. Submittal Register
  - 3.7.5. Preparation of DD Form 1354 (Transfer of Real Property)
  - 3.7.6. Acceptance and Release for Construction
- 3.8. DESIGN COMPLETE CONSTRUCTION DOCUMENT REQUIREMENTS
- 3.9. SUBMITTAL DISTRIBUTION, MEDIA AND QUANTITIES
  - 3.9.1. Submittal Distribution and Quantities
  - 3.9.2. Web based Design Submittals
  - 3.9.3. Mailing of Design Submittals
- 3.10. AS-BUILT DOCUMENTS

**ATTACHMENT A STRUCTURAL INTERIOR DESIGN (SID) REQUIREMENTS**

**ATTACHMENT B FURNITURE, FIXTURES AND EQUIPMENT REQUIREMENTS**

**ATTACHMENT C TRACKING COMMENTS IN DRCHECKS**

**ATTACHMENT D SAMPLE FIRE PROTECTION AND LIFE SAFETY CODE REVIEW**

**ATTACHMENT E LEED SUBMITTALS**

**ATTACHMENT F BUILDING INFORMATION MODELING REQUIREMENTS**

**ATTACHMENT G DESIGN SUBMITTAL DIRECTORY AND SUBDIRECTORY FILE ARRANGEMENT**

## **1.0 GENERAL INFORMATION**

### **1.1. INTRODUCTION**

1.1.1. The information contained in this section applies to the design required after award. After award, the Contractor will develop the accepted proposal into the completed design, as described herein.

1.1.2. The Contractor may elect to fast track the design and construction that is, proceed with construction of parts of the sitework and facilities prior to completion of the overall design. To facilitate fast tracking, the Contractor may elect to divide the design into no more than six (6) design packages per major facility type and no more than three (3) design packages for site and associated work. Designate how it will package the design, consistent with its overall plan for permitting (where applicable) and construction of the project. See Sections 01 33 00 SUBMITTAL PROCEDURES and 01 32 01.00 10 PROJECT SCHEDULE for requirements for identifying and scheduling the design packaging plan in the submittal register and project schedule. See also Sections 01 10 00 STATEMENT OF WORK and 01 57 20.00 10 ENVIRONMENTAL PROTECTION for any specified permit requirements. If early procurement of long-lead item construction materials or installed equipment, prior to completion of the associated design package, is necessary to facilitate the project schedule, also identify those long-lead items and how it will assure design integrity of the associated design package to meet the contract requirements (The Contract consists of the Solicitation requirements and the accepted proposal). Once the Government is satisfied that the long-lead items meet the contract requirements, the Contracting Officer will allow the Contractor to procure the items at its own risk.

1.1.3. The Contractor may proceed with the construction work included in a separate design package after the Government has reviewed the final (100%) design submission for that package, review comments have been addressed and resolved to the Government's satisfaction and the Contracting Officer (or the Administrative Contracting Officer) has agreed that the design package may be released for construction.

1.1.4. **INTEGRATED DESIGN.** To the maximum extent permitted for this project, use a collaborative, integrated design process for all stages of project delivery with comprehensive performance goals for siting, energy, water, materials and indoor environmental quality and ensures incorporation of these goals. Consider all stages of the building lifecycle, including deconstruction.

### **1.2. DESIGNER OF RECORD**

Identify, for approval, the Designer of Record ("DOR") that will be responsible for each area of design. One DOR may be responsible for more than one area. Listed, Professional Registered, DOR(s) shall account for all areas of design disciplines. The DOR's shall stamp, sign, and date each design drawing and other design deliverables under their responsible discipline at each design submittal stage (see contract clause Registration of Designers). If the deliverables are not ready for release for construction, identify them as "preliminary" or "not for release for construction" or by using some other appropriate designation. The DOR(s) shall also be responsible for maintaining the integrity of the design and for compliance with the contract requirements through construction and documentation of the as-built condition by coordination, review and approval of extensions of design, material, equipment and other construction submittals, review and approval or disapproval of requested deviations to the accepted design or to the contract, coordination with the Government of the above activities, and by performing other typical professional designer responsibilities.

## **2.0 PRODUCTS (Not Applicable)**

## **3.0 EXECUTION**

### **3.1. PRE-WORK ACTIVITIES & CONFERENCES**

### 3.1.1. Design Quality Control Plan

Submit for Government acceptance, a Design Quality Control Plan in accordance with Section 01 45 04.00 10 CONTRACTOR QUALITY CONTROL before design may proceed.

### 3.1.2. Post Award Conference

3.1.2.1. The government will conduct a post award contract administration conference at the project site, as soon as possible after contract award. This will be coordinated with issuance of the contract notice to proceed (NTP). The Contractor and major sub-contractor representatives shall participate. All designers need not attend this first meeting. Government representatives will include COE project delivery team members, facility users, facility command representatives, and installation representatives. The Government will provide an agenda, meeting goals, meeting place, and meeting time to participants prior to the meeting.

3.1.2.2. The post award conference shall include determination and introduction of contact persons, their authorities, contract administration requirements, discussion of expected project progress processes, and coordination of subsequent meetings for quality control (see Section 01 45 04.00 10 CONTRACTOR QUALITY CONTROL), Partnering (see below and SCR: Partnering), and the initial design conference (see below).

3.1.2.3. The government will introduce COE project delivery team members, facility users, facility command representatives, and installation representatives. The DB Contractor shall introduce major subcontractors, and other needed staff. Expectations and duties of each person shall be defined for all participants. A meeting roster shall be developed and distributed by the government with complete contact information including name, office, project role, phone, mailing and physical address, and email address.

### 3.1.3. Partnering & Project Progress Processes

3.1.3.1. The initial Partnering conference may be scheduled and conducted at any time with or following the post award conference. The Government proposes to form a partnership with the DB Contractor to develop a cohesive building team. This partnership will involve the COE project delivery team members, facility users, facility command representatives, installation representatives, Designers of Record, major subcontractors, contractor quality control staff, and contractor construction management staff. This partnership will strive to develop a cooperative management team drawing on the strengths of each team member in an effort to achieve a quality project within budget and on schedule. This partnership will be bilateral in membership and participation will be totally voluntary. All costs, excluding labor and travel expenses, shall be shared equally between the Government and the Contractor. The Contractor and Government shall be responsible for their own labor and travel costs. Normally, partnering meetings will be held at or in the vicinity of the project installation.

3.1.3.2. As part of the partnering process, the Government and Contractor shall develop, establish, and agree to comprehensive design development processes including conduct of conferences, expectations of design development at conferences, fast-tracking, design acceptance, Structural Interior Design (SID)/ Furniture, Fixtures & Equipment (FF&E) design approval, project closeout, etc. The government will explain contract requirements and the DB Contractor shall review their proposed project schedule and suggest ways to streamline processes.

### 3.1.4. Initial Design Conference

The initial design conference may be scheduled and conducted at the project installation any time after the post award conference, although it is recommended that the partnering process be initiated with or before the initial design conference. Any design work conducted after award and prior to this conference should be limited to site and is discouraged for other items. All Designers of Record shall participate in

the conference. The purpose of the meeting is to introduce everyone and to make sure any needs the contractor has are assigned and due dates established as well as who will get the information. See also Attachment F, BUILDING INFORMATION MODELING REQUIREMENTS for discussion concerning the BIM Implementation Plan demonstration at this meeting. The DB Contractor shall conduct the initial design conference.

### 3.1.5. Pre-Construction Conference

Before starting construction activities, the Contractor and Government will jointly conduct a pre-construction administrative conference to discuss any outstanding requirements and to review local installation requirements for start of construction. It is possible there will be multiple Pre-Construction Conferences based on the content of the design packages selected by the Contractor. The Government will provide minutes of this meeting to all participants.

## 3.2. STAGES OF DESIGN SUBMITTALS AND OVER THE SHOULDER PROGRESS REVIEWS

The stages of design submittals described below define Government expectations with respect to process and content. The Contractor shall determine how to best plan and execute the design and review process for this project, within the parameters listed below. As a minimum, the Government expects to see at least one interim design submittal, at least one final design submittal before construction of a design package may proceed and at least one Design Complete submittal that documents the accepted design. The Contractor may sub-divide the design into separate packages for each stage of design and may proceed with construction of a package after the Government accepts the final design for that package. See discussion on waivers to submission of one or more intermediate design packages where the parties partner during the design process. See also Attachment F, BUILDING INFORMATION MODELING REQUIREMENTS for discussion concerning BIM and the various stages of design submittals and over-the-shoulder progress reviews.

### 3.2.1. Site/Utilities

To facilitate fast-track design-construction activities the contractor may submit a final (100%) site and utility design as the first design submittal or it may elect to submit interim and final site and utility design submittals as explained below. Following review, resolution, and incorporation of all Government comments, and submittal of a satisfactory set of site/utility design documents, after completing all other pre-construction requirements in this contract and after the pre-construction meeting, the Government will allow the Contractor to proceed with site development activities, including demolition where applicable, within the parameters set forth in the accepted design submittal. For the first site and utility design submission, whether an interim or final, the submittal review, comment, and resolution times from this specification apply, except that the Contractor shall allow the Government a 14 calendar day review period, exclusive of mailing time. No on-site construction activities shall begin prior to written Government clearance to proceed.

### 3.2.2. Interim Design Submittals

The Contractor may submit either a single interim design for review, representing a complete package with all design disciplines, or split the interim design into smaller, individual design packages as it deems necessary for fast-track construction purposes. As required in Section 01 32 01.00 10 PROJECT SCHEDULE, the Contractor shall schedule its design and construction packaging plan to meet the contract completion period. This submission is the Government's primary opportunity to review the design for conformance to the solicitation and to the accepted contract proposal and to the Building Codes at a point where required revisions may be still made, while minimizing lost design effort to keep the design on track with the contract requirements. The requirements for the interim design review submittals and review conferences are described hereinafter. This is not necessarily a hold point for the design process; the Contractor may designate the interim design submittal(s) as a snapshot and proceed with design development at its own risk. See below for a waiver, where the parties establish an effective

over-the-shoulder progress review procedure through the partnering process that would eliminate the need for or expedite a formal intermediate design review on one or more individual design packages.

### 3.2.3. Over-the-Shoulder Progress Reviews

To facilitate a streamlined design-build process, the Government and the Contractor may agree to one-on-one reviewer or small group reviews, electronically, on-line (if available within the Contractor's standard design practices) or at the Contractor's design offices or other agreed location, when practicable to the parties. The Government and Contractor will coordinate such reviews to minimize or eliminate disruptions to the design process. Any data required for these reviews shall normally be provided in electronic format, rather than in hard copy. If the Government and Contractor establish and implement an effective, mutually agreeable partnering procedure for regular (e.g., weekly) over-the-shoulder review procedures that allow the Government reviewers the opportunity to keep fully informed of the progress, contents, design intent, design documentation, etc. of the design package, the Government will agree to waive or to expedite the formal intermediate design review period for that package. The Contractor shall still be required to submit the required intermediate design documentation, however the parties may agree to how that material will be provided, in lieu of a formal consolidated submission of the package. It should be noted that Government funding is extremely limited for non-local travel by design reviewers, so the maximum use of virtual teaming methods must be used. Some possible examples include electronic file sharing, interactive software with on-line or telephonic conferencing, televideo conferencing, etc. The Government must still perform its Code and Contract conformance reviews, so the Contractor is encouraged to partner with the reviewers to find ways to facilitate this process and to facilitate meeting or bettering the design-build schedule. The Contractor shall maintain a fully functional configuration management system as described herein to track design revisions, regardless of whether or not there is a need for a formal intermediate design review. The formal intermediate review procedures shall form the contractual basis for the official schedule, in the event that the partnering process determines that the formal intermediate review process to be best suited for efficient project execution. However, the Government pledges to support and promote the partnering process to work with the Contractor to find ways to better the design schedule.

### 3.2.4. Final Design Submissions

This submittal is required for each design package prior to Government acceptance of that design package for construction. The requirements for the final design submittal review conferences and the Government's acceptance for start of construction are described herein after.

### 3.2.5. Design Complete Submittals

After the final design submission and review conference for a design package, revise the design package to incorporate the comments generated and resolved in the final review conferences, perform and document a back-check review and submit the final, design complete documents, which shall represent released for construction documents. The requirements for the design complete submittals are described hereinafter.

### 3.2.6. Holiday Periods for Government Review or Actions

Do not schedule meetings, Government reviews or responses during the last two weeks of December or other designated Government Holidays (including Friday after Thanksgiving). Exclude such dates and periods from any durations specified herein for Government actions.

### 3.2.7. Late Submittals and Reviews

If the Contractor cannot meet its scheduled submittal date for a design package, it must revise the proposed submittal date and notify the government in writing, at least one (1) week prior to the submittal, in order to accommodate the Government reviewers' other scheduled activities. If a design submittal is

over one (1) day late in accordance with the latest revised design schedule, or if notification of a proposed design schedule change is less than seven (7) days from the anticipated design submission receipt date, the Government review period may be extended up to seven (7) days due to reviewers' schedule conflicts. If the Government is late in meeting its review commitment and the delay increases the Contractor's cost or delays completion of the project, the Suspension of Work and Defaults clauses provide the respective remedy or relief for the delay.

### 3.3. DESIGN CONFIGURATION MANAGEMENT

#### 3.3.1. Procedures

Develop and maintain effective, acceptable design configuration management (DCM) procedures to control and track all revisions to the design documents after the Interim Design Submission through submission of the As-Built documents. During the design process, this will facilitate and help streamline the design and review schedule. After the final design is accepted, this process provides control of and documents revisions to the accepted design (See Special Contract Requirement: Deviating From the Accepted Design). The system shall include appropriate authorities and concurrences to authorize revisions, including documentation as to why the revision must be made. Include the DCM procedures in the Design Quality Control Plan. The DCM data shall be available to the Government reviewers at all times. The Contractor may use its own internal system with interactive Government concurrences, where necessary or may use the Government's "DrChecks Design Review and Checking System" (see below and Attachment C).

#### 3.3.2. Tracking Design Review Comments

Although the Contractor may use its own internal system for overall design configuration management, the Government and the Contractor shall use the DrChecks Design Review and Checking System to initiate, respond to, resolve and track Government design compliance review comments. This system may be useful for other data which needs to be interactive or otherwise available for shared use and retrieval. See Attachment C for details on how to establish an account and set-up the DrChecks system for use on the project.

#### 3.3.3. Design and Code Checklists

Develop and complete various discipline-specific checklists to be used during the design and quality control of each submittal. Submit these completed checklists with each design submittal, as applicable, as part of the project documentation. See Section 01 45 04.00 10 Contractor Quality Control, Attachment D for a Sample Fire Protection and Life Safety Code review checklist and Attachment E for LEED SUBMITTALS.

### 3.4. INTERIM DESIGN REVIEWS AND CONFERENCES

#### 3.4.1. General

At least one interim design submittal, review and review conference is required for each design package (except that, per paragraph 3.2.1, the Contractor may skip the interim design submission and proceed directly to final design on the sitework and utilities package). The DB Contractor may include additional interim design conferences or over-the-shoulder reviews, as needed, to assure continued government concurrence with the design work. Include the interim submittal review periods and conferences in the project schedule and indicate what part of the design work is at what percentage of completion. The required interim design conferences shall be held when interim design requirements are reached as described below. See also Paragraph: **Over-the-Shoulder Progress Reviews** for a waiver to the formal interim design review.

#### 3.4.2. Procedures

After receipt of an Interim Design submission, allow the Government fourteen (14) calendar days after receipt of the submission to review and comment on the interim design submittal. For smaller design packages, especially those that involve only one or a few separate design disciplines, the parties may agree on a shorter review period or alternative review methods (e.g., over-the-shoulder or electronic file sharing), through the partnering process. For each interim design review submittal, the COR will furnish, to the Contractor, a single consolidated, validated listing of all comments from the various design sections and from other concerned agencies involved in the review process using the DrChecks Design Review and Checking System. The review will be for conformance with the technical requirements of the solicitation and the Contractor's RFP proposal. If the Contractor disagrees technically with any comment or comments and does not intend to comply with the comment, he/she must clearly outline, with ample justification, the reasons for noncompliance within five (5) days after receipt of these comments in order that the comment can be resolved. Furnish disposition of all comments, in writing, through DrChecks. The Contractor is cautioned that if it believes the action required by any comment exceeds the requirements of this contract, that it should take no action and notify the COR in writing immediately. The Interim Review conference will be held for each design submittal at the installation. Bring the personnel that developed the design submittal to the review conference. The conference will take place the week after the receipt of the comments by the Contractor. For smaller fast-track packages that involve only a few reviewers, the parties may agree to alternative conferencing methods, such as teleconferencing, or televideo, where available, as determined through Partnering.

#### 3.4.3. Conference Documentation

3.4.3.1. In order to facilitate and accelerate the Government code and contract conformance reviews, identify, track resolution of and maintain all comments and action items generated during the design process and make this available to the designers and reviewers prior to the Interim and subsequent design reviews.

3.4.3.2. The DB Contractor shall prepare meeting minutes and enter final resolution of all comments into DrChecks. Copies of comments, annotated with comment action agreed on, will be made available to all parties before the conference adjourns. Unresolved problems will be resolved by immediate follow-on action at the end of conferences. Incorporate valid comments. The Government reserves the right to reject design document submittals if comments are significant. Participants shall determine if any comments are critical enough to require further design development prior to government concurrence. Participants shall also determine how to proceed in order to obtain government concurrence with the design work presented.

#### 3.5. INTERIM DESIGN REQUIREMENTS

Interim design deliverables shall include drawings, specifications, and design analysis for the part of design that the Contractor considers ready for review.

##### 3.5.1. Drawings

Include comments from any previous design conferences incorporated into the documents to provide an interim design for the "part" submitted.

##### 3.5.2. Design Analyses

3.5.2.1. The designers of record shall prepare and present design analyses with calculations necessary to substantiate and support all design documents submitted. Address design substantiation required by the applicable codes and references and pay particular attention to the following listed items:

3.5.2.2. For parts including sitework, include site specific civil calculations.

3.5.2.3. For parts including structural work, include structural calculations.



- (a) Identify all loads to be used for design.
- (b) Describe the method of providing lateral stability for the structural system to meet seismic and wind load requirements. Include sufficient calculations to verify the adequacy of the method.
- (c) Provide calculations for all principal roof, floor, and foundation members and bracing and secondary members.
- (d) Provide complete seismic analyses for all building structural, mechanical, electrical, architectural, and building features as dictated by the seismic zone for which the facility is being constructed.
- (e) Computer generated calculations must identify the program name, source, and version. Provide input data, including loads, loading diagrams, node diagrams, and adequate documentation to illustrate the design. The schematic models used for input must show, as a minimum, nodes/joints, element/members, materials/properties, and all loadings, induced settlements/deflections, etc., and a list of load combinations. Include an output listing for maximum/minimum stresses/forces and deflections for each element and the reactions for each loading case and combination.
- (f) See also the Security (Anti-Terrorism) requirements below for members subject to Anti-Terrorist Force Protection (ATFP) and Progressive Collapse requirements.
- (g) Fully coordinate and integrate the overall structural design between two different or interfacing construction types, such as modular and stick-built or multistory, stacked modular construction. Provide substantiation of structural, consolidation/settlement analysis, etc., as applicable, through the interfaces.

3.5.2.4. For Security (Anti-Terrorism): Provide a design narrative and calculations where applicable, demonstrating compliance with each of the 22 standards in UFC 4-010-01, which includes Design of Buildings to Resist Progressive Collapse (use the most recent version of UFC 4-023-03, regardless of references to any specific version in UFC 4-010-01). Where sufficient standoff distance is not being provided, show calculations for blast resistance of the structural system and building envelope. Show complete calculations for members subjected to ATFP loads, e.g., support members of glazed items (jambs, headers, sills) connections of windows to support members and connections of support members to the rest of the structure. For 3 story and higher buildings, provide calculations to demonstrate compliance with progressive collapse requirements.

3.5.2.5. For parts including architectural work, include building floor area analysis.

3.5.2.6. For parts including mechanical work, include HVAC analysis and calculations. Include complete design calculations for mechanical systems. Include computations for sizing equipment, compressed air systems, air duct design, and U-factors for ceilings, roofs and exterior walls and floors. Contractor shall employ commercially available energy analysis techniques to determine the energy performance of all passive systems and features. Use of hourly energy load computer simulation is required (see paragraph 3.5.5.2 for list of acceptable software). Based on the results of calculations, provide a complete list of the materials and equipment proposed with the manufacturer's published cataloged product installation specifications and roughing-in data.

3.5.2.7. For parts including life safety, include building code analysis and sprinkler and other suppression systems. Notwithstanding the requirements of the Codes, address the following:

- (a) A registered fire protection engineer (FPE) must perform all fire protection analyses. Provide the fire protection engineer's qualifications. See Section 01 10 00, paragraph 5 for qualifications.
- (b) Provide all references used in the design including Government design documents and industry standards used to generate the fire protection analysis.
- (c) Provide classification of each building in accordance with fire zone, building floor areas and height and number of stories.

(d) Provide discussion and description of required fire protection requirements including extinguishing equipment, detection equipment, alarm equipment and water supply. Alarm and detection equipment shall interface to requirements of Electronic Systems.

(e) Provide hydraulic calculations based on water flow test for each sprinkler system to insure that flow and pressure requirements can be met with current water supply. Include copies of Contractor's water flow testing done to certify the available water source.

3.5.2.8. For parts including plumbing systems:

(a) List all references used in the design.

(b) Provide justification and brief description of the types of plumbing fixtures, piping materials and equipment proposed for use.

(c) Detail calculations for systems such as sizing of domestic hot water heater and piping; natural gas piping; LP gas piping and tanks, fuel oil piping and tanks, etc., as applicable.

(d) When the geotechnical report indicates expansive soils are present, indicate in the first piping design submittal how piping systems will be protected against damage or backfall/backflow due to soil heave (from penetration of slab to the 5 foot building line).

3.5.2.9. For elevator systems:

(a) List all criteria codes, documents and design conditions used.

(b) List any required permits and registrations for construction of items of special mechanical systems and equipment.

3.5.2.10. For parts including electrical work, include lighting calculations to determine maintained foot-candle levels, electrical load analysis and calculations, electrical short circuit and protective device coordination analysis and calculations and arc fault calculations.

3.5.2.11. For parts including telecommunications voice/data (including SIPRNET, where applicable), include analysis for determining the number and placement of outlets

3.5.2.12. For Cathodic Protection Systems, provide the following stamped report by the licensed corrosion engineer or NACE specialist with the first design submission. The designer must be qualified to engage in the practice of corrosion control of buried or submerged metallic surfaces. He/she must be accredited or certified by the National Association of Corrosion Engineers (NACE) as a NACE Accredited Corrosion Specialist or a NACE certified Cathodic Protection Specialist, or must be a registered professional engineer with a minimum of five years experience in corrosion control and cathodic protection. Clearly describe structures, systems or components in soil or water to be protected. Describe methods proposed for protection of each.

3.5.2.13. Air Barrier System: Provide a narrative of the design and installation requirements for the Air Barrier system. As part of the design quality control process an air barrier consultant shall review drawing details to assure that details of critical Air Barrier components are properly detailed and incorporated during the design drawings and process (i.e. window flashing details, penetration in air barrier details, door flashing details, roofing/ceiling barrier interface details and etc.). Furnish the Government written review details and results.

3.5.3. Geotechnical Investigations and Reports:

3.5.3.1. The contractor's licensed geotechnical engineer shall prepare a final geotechnical evaluation report, to be submitted along with the first foundation design submittal. Make this information available as early as possible during the over-the-shoulder progress review process. Summarize the subsurface conditions and provide recommendations for the design of appropriate utilities, foundations, floor slabs, retaining walls, embankments, and pavements. Include compaction requirements for fill and backfill under

buildings, sidewalks, other structures and open areas. Recommend foundation systems to be used, allowable bearing pressures for footings, lateral load resistance capacities for foundation systems, elevations for footings, grade beams, slabs, etc. Provide an assessment of post-construction settlement potential including total and differential. Provide recommendations regarding lateral earth pressures (active, at-rest, passive) to be used in the design of retaining walls. Include the recommended spectral accelerations and Site Class for seismic design along with an evaluation of any seismic hazards and recommendations for mitigation, if required. Include calculations to support the recommendations for bearing capacity, settlement, and pavement sections. Include supporting documentation for all recommended design parameters such as Site Class, shear strength, earth pressure coefficients, friction factors, subgrade modulus, California Bearing Ratio (CBR), etc. Provide earthwork recommendations, expected frost penetration, expected groundwater levels, recommendations for dewatering and groundwater control and the possible presence of any surface or subsurface features that may affect the construction of the project such as sinkholes, boulders, shallow rock, old fill, old structures, soft areas, or unusual soil conditions. Include pH tests, salinity tests, resistivity measurements, etc., required to design corrosion control and grounding systems. Include the raw field data. Arrange a meeting with the Government subsequent to completion and evaluation of the site specific geotechnical exploration to outline any differences encountered that are inconsistent with the Government provided preliminary soils information. Clearly outline differences which require changes in the foundation type, or pavement and earthwork requirements from that possible and contemplated using the Government furnished preliminary soils investigation, which result in a change to the design or construction. Any equitable adjustment is subject to the provisions of the contract's Differing Site Conditions Clause.

3.5.3.2. Vehicle Pavements: The Contractor's geotechnical report shall contain flexible and rigid pavement designs, as applicable for the project, including design CBR and modulus of subgrade reaction and the required compaction effort for subgrades and pavement layers. Provide Information on the types of base course materials available in the area and design strengths.

3.5.3.3. The Contractor and the professional geotechnical engineer consultant shall certify in writing that the design of the project has been developed consistent with the Contractor's final geotechnical report. The certification shall be stamped by the consulting professional geotechnical engineer and shall be submitted with the first design submission. If revisions are made to the initial design submission, a new certification shall be provided with the final design submission.

#### 3.5.4. LEED Documentation:

Assign a LEED Accredited Professional, responsible to track LEED planning, performance and documentation for each LEED credit through construction closeout. Incorporate LEED credits in the plans, specifications and design analyses. Develop LEED supporting documentation as a separable portion of the Design Analysis and provide with each required design submittal. Include the LEED Project checklist for each non-exempt facility (one checklist may be provided for multiple facilities in accordance with the LEED-NC Application Guide for Multiple Buildings and On-Campus Building Projects and the LEED SUBMITTALS (Attachment E, herein) with each submittal. Final design submittal for each portion of the work must include all required design documentation relating to that portion of work (example - all site credit design documents with final site design). Submittal requirements are as indicated in Attachment E, LEED SUBMITTALS. Submit all documentation indicated on Attachment E as due at final design at final design submittal (for fast-track projects with multiple final design submittals, this shall be at the last scheduled final design submittal). All project documentation related to LEED shall conform to USGBC requirements for both content and format, including audit requirements and be separate from other design analyses. Maintain and update the LEED documentation throughout project progress to construction closeout and shall compile product data, receipts, calculations and other data necessary to substantiate and support all credits claimed. The Government may audit any or all individual credits. Audit documentation is not required to be submitted unless requested. These requirements apply to all projects. If the project requires the Contractor to obtain USGBC certification, the Contractor shall also be responsible for obtaining USGBC certification and shall provide written evidence of certification with the construction closeout LEED documentation submittal. Install the USGBC building plaque at the location

indicated by the Government upon receipt. If Contractor obtains USGBC interim design review, submit the USGBC review to the Government within 30 days of receipt for information only.

3.5.4.1. LEED Documentation for Technology Solution Set. If the Solicitation provides a Prescriptive Technology Solution Set, use of the Technology Solution set has no effect on LEED documentation requirements. Provide all required LEED documentation, including energy analysis, in accordance with LEED requirements when using the Technology Solution Set.

### 3.5.5. Energy Conservation:

3.5.5.1. Refer to Section 01 10 00, Paragraph 5. Interim and Final Design submittals shall demonstrate that each building including the building envelope, HVAC systems, service water heating, power, and lighting systems meet the Mandatory Provisions and the Prescriptive Path requirements of ASHRAE 90.1. Use Compliance Documentation forms available from ASHRAE and included in the ASHRAE 90.1 User's Manual for this purpose. The Architectural Section of the Design Analysis shall include completed forms titled "Building Envelope Compliance Documentation Parts I and II". The Heating Ventilating and Air Conditioning (HVAC) Section of the Design Analysis shall include a completed form titled "HVAC Simplified Approach Option - Part I" if this approach is allowed by the Standard. Otherwise, the HVAC Section of the Design Analysis shall include completed forms titled "HVAC Mandatory Provisions - Part II" and "HVAC Prescriptive Requirements - Part III". The Plumbing Section of the Design Analysis shall include a completed form titled "Service Water Heating Compliance Documentation". The Electrical Section of the Design Analysis shall include an explanatory statement on how the requirements of ASHRAE 90.1 Chapter 8 Power were met. The Electrical Section of the Design Analysis shall also include a completed form titled "Lighting Compliance Documentation".

3.5.5.2. Interim and Final Design submittals which address energy consuming systems, (heating, cooling, service hot water, lighting, power, etc.) must also include calculations in a separate Energy Conservation Section of the Design Analysis which demonstrate and document (a) the baseline energy consumption for the facility or facilities under contract, that would meet the requirements of ANSI/ASHRAE/IESNA Standard 90.1 and (b) the energy consumption of the facility or facilities under contract utilizing the materials and methods required by this construction contract. Use the USGBC Energy and Atmosphere (EA) Credit 1 compliance template / form or an equivalently detailed form for documenting compliance with the energy reduction requirements. This template / form is titled PERFORMANCE RATING METHOD and is available when the project is registered for LEED. The calculation methodology used for this documentation and analysis shall follow the guidelines set forth in Appendix G of ASHRAE 90.1, with two exceptions: a) receptacle and process loads may be omitted from the calculation; and b) the definition of the terms in the formula for Percentage Improvement found in paragraph G1.2 are modified as follows: Baseline Building Performance shall mean the annual energy consumption calculated for a building design intended for use as a baseline for rating above standard design meeting the minimum requirements of the energy standard, and Proposed Building Performance shall mean annual energy consumption calculated for the proposed building design intended for construction. This calculation shall address all energy consuming systems in a single integrated methodology. Include laboratory fume hoods and kitchen ventilation loads in the energy calculation. They are not considered process loads. Individual calculations for heating, cooling, power, lighting, power, etc. systems will not be acceptable. The following building simulation software is acceptable for use in calculating building energy consumption: Hourly Analysis Program (HAP) by Carrier Corp., TRACE 700 by Trane Corp., DOE-2 by US Department of Energy, EnergyPlus by DOD/DOE.

### 3.5.6. Specifications

Specifications may be any one of the major, well known master guide specification sources. Use only one source. Examples include specifications from MASTERSPEC from the American Institute of Architects, SPECTEXT from Construction Specification Institute or Unified Facility Guide Specifications (UFGS using MASTERFORMAT 2004 numbering system), etc. The UFGS are available through the "Whole Building Design Guide" website, using a websearch engine. Manufacturers' product specifications, utilizing CSI's Manu-Spec, three part format may be used in conjunction with the selected

specifications. The designers of record shall edit and expand the appropriate Specifications to insure that all project design requirements, current code requirements, and regulatory requirements are met. Specifications shall clearly identify, where appropriate, specific products chosen to meet the contract requirements (i.e., manufacturers' brand names and model numbers or similar product information). Note that the UFGS are NOT written for Design-Build and must be edited appropriately. For instance, they assume that the Government will approve most submittals, whereas in Design-Build, the Designer of Record has that action, unless this Solicitation requires Government approval for specific submittals. The Designer of Record should also note that some UFGS sections might either prescribe requirements exceeding the Government's own design standards in applicable references or contain requirements that should be selected where appropriately required by the applicable references. At any rate, where the UFGS are consistent with other major, well known master commercial guide specifications, then generally retain such requirements, as good practices.

#### 3.5.7. Building Rendering

Present and provide a draft color computer, artist, or hand drawn rendering with the conceptual design submittal of the building exterior. Perspective renderings shall include a slightly overhead view of the entire building to encompass elevations and the roof configuration of the building. After Government review and acceptance, provide a final rendering, including the following:

Three (3) 18" x 24" color prints, framed and matted behind glass with project title underneath the print.

One (1) Image file (high resolution) in JPG format on CD for those in the submittal distribution list.

#### 3.5.8. Interim Building Design Contents

The following list represents what the Government considers should be included in the overall completed design for a facility or project. It is not intended to limit the contractor from providing different or additional information as needed to support the design presented, including the require design analyses discussed above. As the Contractor develops individual design packages and submits them for Interim review, include as much of the applicable information for an individual design package as is developed at the Interim design level for review purposes. These pieces shall be developed as the design progresses toward the design complete stage.

##### 3.5.8.1. Lawn and Landscaping Irrigation System

##### 3.5.8.2. Landscape, Planting and Turfing

##### 3.5.8.3. Architectural

- (a) Design Narrative
- (b) Architectural Floor Plans, Typical Wall and Roof Sections, Elevations
- (c) Finish schedule
- (d) All required equipment
- (e) Special graphics requirements
- (f) Door and Window Schedules
- (g) Hardware sets using BHMA designations
- (h) Composite floor plan showing all pre-wired workstations
- (i) Structural Interior Design (SID) package: See ATTACHMENT A for specific requirements
- (j) Furniture, Fixtures & Equipment (FF&E) design package: See ATTACHMENT B for specific requirements

(k) Air Barrier Design: Details of all Air Barrier components, (i.e. window flashing details, penetrations in air barrier details, door flashing details, roofing/ceiling barrier interface details and etc.)

3.5.8.4. Structural Systems. Include:

- (a) Drawings showing principal members for roof and floor framing plans as applicable
- (b) Foundation plan showing main foundation elements where applicable
- (c) Typical sections for roof, floor, and foundation conditions

3.5.8.5. Plumbing Systems

- (a) Show locations and general arrangement of plumbing fixtures and major equipment
- (b) Plan and isometric riser diagrams of all areas including hot water, cold water, waste and vent piping. Include natural gas (and meter as required), (natural gas and meter as required), (LP gas), (fuel oil) and other specialty systems as applicable.
- (c) Include equipment and fixture connection schedules with descriptions, capacities, locations, connection sizes and other information as required

3.5.8.6. HVAC Systems

- (a) Mechanical Floor Plans: The floor plans shall show all principle architectural features of the building which will affect the mechanical design. The floor plans shall also show the following:
  - (1) Room designations.
  - (2) Mechanical legend and applicable notes.
  - (3) Location and size of all ductwork and piping.
  - (4) Location and capacity of all terminal units (i.e., registers, diffusers, grilles, hydronic baseboards).
  - (5) Pre-Fabricated Paint Spray Booth (where applicable to project scope)
  - (6) Paint Preparation Area (where applicable to project scope)
  - (7) Exhaust fans and specialized exhaust systems.
  - (8) Thermostat location.
  - (9) Location of heating/cooling plant (i.e., boiler, chiller, cooling tower, etc).
  - (10) Location of all air handling equipment.
  - (11) Air balancing information.
  - (12) Flue size and location.
  - (13) Piping diagram for forced hot water system (if used).
- (b) Equipment Schedule: Provide complete equipment schedules. Include:
  - (1) Capacity
  - (2) Electrical characteristics
  - (3) Efficiency (if applicable)
  - (4) Manufacturer's name
  - (5) Optional features to be provided
  - (6) Physical size
  - (7) Minimum maintenance clearances

- (a) Details: Provide construction details, sections, elevations, etc., only where required for clarification of methods and materials of design.
- (b) HVAC Controls: Submit complete HVAC controls equipment schedules, sequences of operation, wiring and logic diagrams, Input/Output Tables, equipment schedules, and all associated information. See the Statement of Work for additional specific requirements.

#### 3.5.8.7. Fire Protection and Life Safety.

- (a) Provide plan for each floor of each building that presents a compendium of the total fire protection features being incorporated into the design. Include the following types of information:
  - (1) The location and rating of any fire-resistive construction such as occupancy separations, area separations, exterior walls, shaft enclosures, corridors, stair enclosures, exit passageways, etc.
  - (2) The location and coverage of any fire detection systems
  - (3) The location and coverage of any fire suppression systems (sprinkler risers, standpipes, etc.)
  - (4) The location of any other major fire protection equipment
  - (5) Indicate any hazardous areas and their classification
  - (6) Schedule describing the internal systems with the following information: fire hazard and occupancy classifications, building construction type, GPM/square foot sprinkler density, area of operation and other as required
- (b) Working plans and all other materials submitted shall meet NFPA 13 requirements, with respect to required minimum level of detail.

#### 3.5.8.8. Elevators. Provide:

- (a) Description of the proposed control system
- (b) Description, approximate capacity and location of any special mechanical equipment for elevators.

#### 3.5.8.9. Electrical Systems.

- (a) Electrical Floor Plan(s): Show all principle architectural features of the building which will affect the electrical design. Show the following:
  - (1) Room designations.
  - (2) Electrical legend and applicable notes.
  - (3) Lighting fixtures, properly identified.
  - (4) Switches for control of lighting.
  - (5) Receptacles.
  - (6) Location and designation of panelboards. Clearly indicate type of mounting required (flush or surface) and reflect accordingly in specifications.
  - (7) Service entrance (conduit and main disconnect).
  - (8) Location, designation and rating of motors and/or equipment which requires electrical service. Show method of termination and/or connection to motors and/or equipment. Show necessary junction boxes, disconnects, controllers (approximate only), conduit stubs, and receptacles required to serve the motor and/or equipment.
- (b) Building Riser Diagram(s) (from pad-mounted transformer to unit load center panelboard): Indicate the types and sizes of electrical equipment and wiring. Include grounding and metering requirements.

- (c) Load Center Panelboard Schedule(s): Indicate the following information:
  - (1) Panelboard Characteristics (Panel Designation, Voltage, Phase, Wires, Main Breaker Rating and Mounting).
  - (2) Branch Circuit Designations.
  - (3) Load Designations.
  - (4) Circuit Breaker Characteristics. (Number of Poles, Trip Rating, AIC Rating)
  - (5) Branch Circuit Connected Loads (AMPS).
  - (6) Special Features
- (d) Lighting Fixture Schedule(s): Indicate the following information:
  - (1) Fixture Designation.
  - (2) General Fixture Description.
  - (3) Number and Type of Lamp(s).
  - (4) Type of Mounting.
  - (5) Special Features.
- (e) Details: Provide construction details, sections, elevations, etc. only where required for clarification of methods and materials of design.

3.5.8.10. Electronic Systems including the following responsibilities:

- (a) Fire Detection and Alarm System. Design shall include layout drawings for all devices and a riser diagram showing the control panel, annunciator panel, all zones, radio transmitter and interfaces to other systems (HVAC, sprinkler, etc.)
- (b) Fire Suppression System Control. Specify all components of the Fire Suppression (FS) System in the FS section of the specifications. Clearly describe how the system will operate and interact with other systems such as the fire alarm system. Include a riser diagram on the drawings showing principal components and interconnections with other systems. Include FS system components on drawing legend. Designate all components shown on floor plans "FS system components" (as opposed to "Fire Alarm components"). Show location of FS control panels, HVAC control devices, sensors, and 120V power panel connections on floor plans. Indicate zoning of areas by numbers (1, 2, 3) and detectors sub-zoned for cross zoning by letter designations (A and B). Differentiate between ceiling mounted and under floor detectors with distinct symbols and indicate sub-zone of each.
- (c) Public Address System
- (d) Special Grounding Systems. Completely reflect all design requirements in the specifications and drawings. Specifications shall require field tests (in the construction phase), witnessed by the Government, to determine the effectiveness of the grounding system. Include drawings showing existing construction, if any.
- (e) Cathodic Protection.
- (f) Intrusion Detection, Card Access System
- (g) Central Control and Monitoring System
- (h) Mass Notification System
- (i) Electrical Power Distribution Systems

3.5.8.11. Separate detailed Telecommunications drawings for Information Systems including the following responsibilities:

- (a) Telecommunications Cabling



(b) Supporting Infrastructure

(c) Outside Plant (OSP) Cabling - Campus or Site Plans - Exterior Pathways and Inter-Building Backbones

(d) Include a layout of the voice/data outlets (including voice only wall & pay phones) on telecommunication floor plan drawing, location of SIPRNET data outlets (where applicable), and a legend and symbol definition to indicate height above finished floor. Show size of conduit and cable type and size on Riser Diagram. Do not show conduit runs between backboard and outlets on the floor plans. Show underground distribution conduit and cable with sizing from point of presence to entrance facility of building.

(e) Layout of complete building per floor - Serving Zone Boundaries, Backbone Systems, and Horizontal Pathways including Serving Zones Drawings - Drop Locations and Cable ID's

(f) Communication Equipment Rooms - Plan Views - Tech and AMEP/Elevations - Racks and Walls. Elevations with a detailed look at all telecomm rooms. Indicate technology layout (racks, ladder-racks, etc.), mechanical/electrical layout, rack elevation and backboard elevation. They may also be an enlargement of a congested area of T1 or T2 series drawing.

### 3.6. FINAL DESIGN REVIEWS AND CONFERENCES

A final design review and review conference will be held upon completion of final design at the project installation, or – where equipment is available - by video teleconference or a combination thereof, for any design package to receive Government acceptance to allow release of the design package for construction. For smaller separate design packages, the parties may agree on alternative reviews and conferences (e.g., conference calls and electronic file sharing, etc.) through the Partnering process. Include the final design conference in the project schedule and shall indicate what part of the design work is at 100% completion. The final design conference will be held after the Government has had seven (7) calendar days after receipt of the submission to review the final design package and supporting data. For smaller packages, especially those involving only one or a few design disciplines the parties may agree on a shorter period.

### 3.7. FINAL DESIGN REQUIREMENTS

Final design deliverables for a design package shall consist of 100% complete drawings, specifications, submittal register and design analyses for Government review and acceptance. The 100% design submission shall consist of drawings, specifications, updated design analyses and any permits required by the contract for each package submitted. In order to expedite the final design review, prior to the conference, ensure that the design configuration management data and all review comment resolutions are up-to-date. Include the 100% SID and 100% FF&E binders for government approval. The Contractor shall have performed independent technical reviews (ITR's) and back-checks of previous comment resolutions, as required by Section 01 45 04.00 10 CONTRACTOR QUALITY CONTROL, including providing documentation thereof. Use DrChecks or other acceptable comment tracking system during the ITR and submit the results with each final design package

#### 3.7.1. Drawings

3.7.1.1. Submit drawings complete with all contract requirements incorporated into the documents to provide a 100% design for each package submitted.

3.7.1.2. Prepare all drawings with the Computer-Aided Design and Drafting (CADD)/Computer-Aided Design (CAD) system, organized and easily referenced electronically, presenting complete construction information.

3.7.1.3. Drawings shall be complete. The Contractor is encouraged to utilize graphics, views, notes, and details which make the drawings easier to review or to construct but is also encouraged to keep such materials to those that are necessary.

3.7.1.4. Provide detail drawings that illustrate conformance with the contract. Include room finish schedules, corresponding color/finish/special items schedules, and exterior finish schedules that agree with the submitted SID binders.

3.7.1.5. The design documents shall be in compliance with the latest version of the A/E/C CAD Standard, available at <https://cadbim.usace.army.mil/CAD>. Use the approved vertical Corps of Engineers title blocks and borders on all drawings with the appropriate firm name included within the title block area.

3.7.1.6. CAD System and Building Information Modeling (BIM) (NOTE: If this is a Single Award or Multiple Award, Indefinite Delivery/Indefinite Quantity Contract, this information will be provided for each task order.)

All CAD files shall be fully compatible with MicroStation V8 or higher. Save all design CAD files as MicroStation V8 or higher files. All submitted BIM Models and associated Facility Data shall be fully compatible with Bentley BIM [Not Supplied - SubmittalReqCADDSystem : BENTLEY\_VERSION] and the USACE Bentley BIM Workspace [Not Supplied - SubmittalReqCADDSystem : USACE\_WORKSPACE\_VERSION]

(a) CAD Data Final File Format: During the design development capture geo-referenced coordinates of all changes made to the existing site (facility footprint, utility line installations and alterations, roads, parking areas, etc) as a result of this contract. There is no mandatory methodology for how the geo-referenced coordinates will be captured, however, Engineering and Construction Bulletin No. 2006-15, Subject: Standardizing Computer Aided Design (CAD) and Geographic Information Systems (GIS) Deliverables for all Military Design and Construction Projects identifies the format for final as-built drawings and data sets to be delivered to the government. Close-out requirements at the as-built stage; require final geo-referenced GIS Database of the new facility along with all exterior modifications. The Government will incorporate this data set into the Installation's GIS Masterplan or Enterprise GIS System. See also, Section 01 78 02.00 10 Closeout Submittals.

(b) Electronic Drawing Files: In addition to the native CAD design files, provide separate electronic drawing files (in editable CAD format and Adobe Acrobat PDF version 7.0 or higher) for each project drawing.

(c) Each file (both CAD and PDF) shall represent one complete drawing from the drawing set, including the date, submittal phase, and border. Each drawing file shall be completely independent of any data in any other file, including fonts and shapes not included with the basic CAD software program utilized. Fonts that are not included as part of the default CAD software package installation or recognized as an allowable font by the A/E/C CAD Standard are not acceptable in delivered CAD files. All displayed graphic elements on all levels of the drawing files shall be part of the project drawing image. The drawing files shall not contain any graphic element that is not part of the drawing image.

(d) Deliver BIM Model and associated Facility Data files in their native format. At a minimum, BIM files shall address major architecture design elements, major structural components, mechanical systems and electrical/communication distribution and elements as defined in Attachment F. See Attachment F for additional BIM requirements.

(e) Drawing Index: Provide an index of drawings sheet in CAD as part of the drawing set, and an electronic list in Microsoft Excel of all drawings on the CD. Include the electronic file name, the sheet reference number, the sheet number, and the sheet title, containing the data for each drawing.

(f) Hard Copies: Plot submitted hard copy drawings directly from the "electronic drawing files" and copy for quantities and sizes indicated in the distribution list at the end of this specification section. The Designers of Record shall stamp, sign and date original hard copy sheets as Released For Construction, and provide copies for distribution from this set.

### 3.7.2. Design Analyses

3.7.2.1. The designers of record shall update, finalize and present design analyses with calculations necessary to substantiate and support all design documents submitted.

3.7.2.2. The responsible DOR shall stamp, sign and date the design analysis. Identify the software used where, applicable (name, version, vendor). Generally, provide design analyses, individually, in an original (file copy) and one copy for the assigned government reviewer.

3.7.2.3. All disciplines review the LEED design analysis in conjunction with their discipline-specific design analysis; include a copy of the separable LEED design analysis in all design analysis submittals.

3.7.2.4. Do not combine multi-disciplined volumes of design-analysis, unless multiple copies are provided to facilitate multiple reviewers (one copy per each separate design analysis included in a volume).

### 3.7.3. Specifications

Specifications shall be 100% complete and in final form.

### 3.7.4. Submittal Register

Prepare and update the Submittal Register and submit it with the 100% design specifications (see Specification Section 01 33 00, SUBMITTAL PROCEDURES) with each design package. Include the required submittals for each specification section in a design package in the submittal register.

### 3.7.5. Preparation of DD Form 1354 (Transfer of Real Property)

This form itemizes the types, quantities and costs of various equipment and systems that comprise the project, for the purpose of transferring the new construction project from the Corps Construction Division to the Installation's inventory of real property. The Government will furnish the DB Contractor's design manager a DD Form 1354 checklist to use to produce a draft Form 1354. Submit the completed checklist and prepared draft Form DD 1354 with the 100% design in the Design Analysis. The Corps will use these documents to complete the final DD 1354 upon completion of construction.

### 3.7.6. Acceptance and Release for Construction

3.7.6.1. At the conclusion of the Final Design Review (after resolutions to the comments have been agreed upon between DOR and Government reviewers), the Contracting Officer or the ACO will accept the Final Design Submission for the design package in writing and allow construction to start for that design package. The Government may withhold acceptance until all major corrections have been made or if the final design submission requires so many corrections, even though minor, that it isn't considered acceptably complete.

3.7.6.2. Government review and acceptance of design submittals is for contract conformance only and shall not relieve the Contractor from responsibility to fully adhere to the requirements of the contract, including the Contractor's accepted contract proposal, or limit the Contractor's responsibility of design as prescribed under Special Contract Requirement: "Responsibility of the Contractor for Design" or limit the Government's rights under the terms of the contract. The Government reserves the right to rescind inadvertent acceptance of design submittals containing contract deviations not separately and expressly identified in the submittal for Government consideration and approval.

## 3.8. DESIGN COMPLETE CONSTRUCTION DOCUMENT REQUIREMENTS

After the Final Design Submission and Review Conference and after Government acceptance of the Final Design submission, revise the design documents for the design package to incorporate the comments

generated and resolved in the final review conference, perform and document a back-check review and submit the final, design complete documents. Label the final design complete documents "FOR CONSTRUCTION" or use similar language. In addition to the final drawings and specifications, the following deliverables are required for distribution and field use. The deliverable includes all documentation and supporting design analysis in final form, as well as the final review comments, disposition and the back-check. As part of the quality assurance process, the Government may perform a back-check of the released for construction documentation. Promptly correct any errors or omissions found during the Government back-check. The Government may withhold retainage from progress payments for work or materials associated with a final design package until this submittal has been received and the Government determines that it is complete.

### 3.9. SUBMITTAL DISTRIBUTION, MEDIA AND QUANTITIES

#### 3.9.1. Submittal Distribution and Quantities

General: The documents which the Contractor shall submit to the Government for each submittal are listed and generally described in preceding paragraphs in this Section. Provide copies of each design submittal and design substantiation as follows (NOTE: If this is a Single Award or Multiple Award, Indefinite Delivery/Indefinite Quantity Contract, this information will be provided for each task order):

Activity and Address	Drawing Size (Full Size) <b><u>ANSI D</u></b> Full Sets/ *Partial Sets	Design Analyses & Specs Full Sets/ *Partial Sets	Drawing Size (Half Size) <b><u>ANSI B</u></b> Full Sets/ *Partial Sets	Non-BIM Data CD-ROM or DVD as Necessary (PDF& <b><u>.dgn</u></b> )	Furniture Submittal (Per Attachment B)	Structural Interior Design Submittal	BIM Data DVD (Per Attach F)
Commander, U.S.Army Engineer District <b>Baltimore</b>	0/0	5/0	5/0	2	1	2	1
Commander, U.S.Army Engineer District, Center of Standardization <b>USAESCH</b>	1/0	2/0	2/1	2	N/A	2	2
Installation	1/0	2/0	2/0	2	2	2	1
U.S.Army Corps of Engineers Construction Area Office	5/0	5/0	10/0	10	1	5	0
Information Systems Engineering Command (ISEC)	0/0	0/1	0/0	1	*Partial Set (Work Station/System Furniture- IT Details)	N/A	1

Activity and Address	Drawing Size (Full Size) <b><u>ANSI D</u></b> Full Sets/ *Partial Sets	Design Analyses & Specs Full Sets/ *Partial Sets	Drawing Size (Half Size) <b><u>ANSI B</u></b> Full Sets/ *Partial Sets	Non-BIM Data CD-ROM or DVD as Necessary (PDF & <b><u>.dgn</u></b> )	Furniture Submittal (Per Attachment B)	Structural Interior Design Submittal	BIM Data DVD (Per Attachment F)
Huntsville Engineer & Support Center, Central Furnishings Program	N/A	N/A	N/A	N/A	1 Interim/Refer to attachment B for the final submission Qty	N/A	N/A
Other Offices	1/0	1/0	1/0	1	N/A	1	0

**\*NOTE: For partial sets of drawings, specifications and design analyses, see paragraph 3.9.3.3, below.**

**\*\*NOTE: When specified below in 3.9.2, furnish Installation copies of Drawings as paper copies, in lieu of the option to provide secure web-based submittals.**

### 3.9.2. Web based Design Submittals

Web based design submittals will be acceptable as an alternative to the paper copies listed in the Table above, provided a single hard-copy PDF based record set is provided to the Contracting Officer for record purposes. Where the contract requires the Contractor to submit documents to permitting authorities, still provide those authorities paper copies (or in an alternate format where required by the authority). Web based design submittal information shall be provided with adequate security and availability to allow unlimited access those specifically authorized to Government reviewers while preventing unauthorized access or modification. File sizes must be of manageable size for reviewers to quickly download or open on their computers. As a minimum, drawings shall be full scale on American National Standards Institute (ANSI) D sheets (34" x 22"). In addition to the optional website, provide the BIM data submission on DVD to each activity and address noted above in paragraph 3.9.1 for each BIM submission required in Attachment F.

### 3.9.3. Mailing of Design Submittals

3.9.3.1. Mail all design submittals to the Government during design and construction, using an overnight mailing service. The Government will furnish the Contractor addresses where each copy shall be mailed to after award of the contract (or individual task order if this is an indefinite delivery/indefinite quantity, task order contract). Mail the submittals to fifteen (15) different addresses. Assemble drawing sheets, specs, design analyses, etc. into individual sets; do not combine duplicate pages from individual sets so that the government has to assemble a set.

3.9.3.2. Each design submittal shall have a transmittal letter accompanying it indicating the date, design percentage, type of submittal, list of items submitted, transmittal number and point of contact with telephone number.

3.9.3.3. Provide partial sets of drawings, specifications, design analyses, etc., as designated in the Table in paragraph 3.9.1, to those reviewers who only need to review their applicable portions of the design,

such as the various utilities. The details of which office receives what portion of the design documentation will be worked out after award.

### 3.10. AS-BUILT DOCUMENTS

Provide as-built drawings and specifications in accordance with Section 01 78 02.00 10, CLOSEOUT SUBMITTALS. Update LEED design phase documentation during construction as needed to reflect construction changes and advancing project completion status (example - Commissioning Plan updates during construction phase) and include updated LEED documentation in construction closeout submittal.

## **ATTACHMENT A STRUCTURAL INTERIOR DESIGN (SID) REQUIREMENTS**

### **1.0 GENERAL INFORMATION**

Structural Interior Design includes all building related elements and components generally part of the building itself, such as wall finishes, ceilings finishes, floor coverings, marker/bulletin boards, blinds, signage and built in casework. Develop the SID in conjunction with the furniture footprint.

### **2.0 STRUCTURAL INTERIOR DESIGN (SID) REQUIREMENTS FOR THE INTERIM AND FINAL DESIGN SUBMITTALS**

#### **2.1. FORMAT AND SCHEDULE**

Prepare and submit for approval an interior and exterior building finishes scheme for an interim design submittal. The DOR shall meet with and discuss the finish schemes with the appropriate Government officials prior to preparation of the schemes to be presented. Present original sets of the schemes to reviewers at an interim design conference.

At the conclusion of the interim phase, after resolutions to the comments have been agreed upon between DOR and Government reviewers, the Contractor may proceed to final design with the interior finishes scheme presented.

The SID information and samples are to be submitted in 8 ½" x 11" format using three ring binders with pockets on the inside of the cover. When there are numerous pages with thick samples, use more than one binder. Large D-ring binders are preferred to O-ring binders. Use page protectors that are strong enough to keep pages from tearing out. Anchor large or heavy samples with mechanical fasteners, Velcro, or double-faced foam tape rather than rubber cement or glue. Fold out items must have a maximum spread of 25 ½". Provide cover and spine inserts sheets identifying the document as "Structural Interior Design" package. Include the project title and location, project number, Contractor/A/E name and phone number(s), submittal stage and date.

Design submittal requirements include, but are not limited to:

##### **2.1.1. Narrative of the Structural Interior Design Objectives**

The SID shall include a narrative that discusses the building related finishes. Include topics that relate to base standards, life safety, sustainable design issues, aesthetics, durability and maintainability, discuss the development and features as they relate to the occupants requirements and the building design.

##### **2.1.2. Interior Color Boards**

Identify and key each item on the color boards to the contract documents to provide a clear indication of how and where each item will be used. Arrange finish samples to the maximum extent possible by room type in order to illustrate room color coordination. Label all samples on the color boards with the manufacturer's name, patterns and colors name and number. Key or code samples to match key code system used on contract drawings.

Material and finish samples shall indicate true pattern, color and texture. Provide photographs or colored photocopies of materials or fabrics to show large overall patterns in conjunction with actual samples to show the actual colors. Finish samples must be large enough to show a complete pattern or design where practical.

Color boards shall include but not be limited to original color samples of the following:

All walls finishes and ceiling finishes, including corner guards, acrylic wainscoting and wall guards/chair rail finishes

All tile information, including tile grout color and tile patterns.

- All flooring finishes, including patterns.
- All door, door frame finishes and door hardware finishes
- All signage, wall base, toilet partitions, locker finishes and operable/folding partitions and trim
- All millwork materials and finishes (cabinets, counter tops, etc.)
- All window frame finishes and window treatments (sills, blinds, etc.)

Color board samples shall reflect all actual finish textures, patterns and colors required as specified. Patterned samples shall be of sufficient size to adequately show pattern and its repeat if a repeat occurs.

### 2.1.3. Exterior Color Boards

Prepare exterior finishes color boards in similar format as the interior finishes color boards, for presentation to the reviewers during an interim design conference. Provide original color samples of all exterior finishes including but not limited to the following:

- All Roof Finishes
- All Brick and Cast Stone Samples
- All Exterior Insulation and Finish Samples
- All Glass Color Samples
- All Exterior Metals Finishes
- All Window & Door Frame Finishes
- All Specialty Item Finishes, including trim

Identify each item on the exterior finishes color boards and key to the building elevations to provide a clear indication of how and where each item will be used.

## 2.2. STRUCTURAL INTERIOR DESIGN DOCUMENTS

### 2.2.1. General

Structural interior design related drawings must indicate the placement of extents of SID material, finishes and colors and must be sufficiently detailed to define all interior work. The following is a list of minimum requirements:

### 2.2.2. Finish Color Schedule

Provide finish color schedule(s) in the contract documents. Provide a finish code, material type, manufacturer, series, and color designations. Key the finish code to the color board samples and drawings.

### 2.2.3. Interior Finish Plans

Indicate wall and floor patterns and color placement, material transitions and extents of interior finishes.

### 2.2.4. Furniture Footprint Plans

Provide furniture footprint plans showing the outline of all freestanding and systems furniture for coordination of all other disciplines.

### 2.2.5. Interior Signage



Include interior signage plans or schedules showing location and quantities of all interior signage. Key each interior sign to a quantitative list indicating size, quantity of each type and signage text.

2.2.6. Interior Elevations, Sections and Details

Indicate material, color and finish placement.

**ATTACHMENT B**  
**FURNITURE, FIXTURES & EQUIPMENT (FF&E) REQUIREMENTS**

**1.0 FF&E REQUIREMENTS FOR THE INTERIM AND FINAL DESIGN SUBMITTALS**

**1.1. FORMAT AND SCHEDULE**

Prepare and submit for approval a comprehensive FF&E scheme for an interim design submittal. The Contractor's interior designer, NOT A FURNITURE DEALER, shall develop the design. FF&E is the selection, layout, specification and documentation of furniture and includes but is not limited to workstations, seating, tables, storage and shelving, filing, trash receptacles, clocks, framed artwork, artificial plants, and other accessories. Contract documentation is required to facilitate pricing, procurement and installation. The FF&E package is based on the furniture footprint developed in the Structural Interior Design (SID) portion of the interior design. Develop the FF&E package concurrently with the building design to ensure that there is coordination between the electrical outlets, switches, J-boxes, communication outlets and connections, and lighting as appropriate. In addition, coordinate layout with other building features such as architectural elements, thermostats, location of TV's, GF/GI equipment (for example computers, printers, copiers, shredders, faxes), etc. Locate furniture in front of windows only if the top of the item falls below the window and unless otherwise noted, do not attach furniture including furniture systems to the building. If project has SIPRNET and/or NIPRNET, coordinate furniture layout with SIPRNET and NIPRNET separation requirements. Verify that access required by DOIM for SIPRNET box and conduit is provided. The DOR shall interview appropriate Government personnel to determine FF&E requirements for furniture and furnishings prior to preparation of the scheme to be presented. Determine FFE items and quantities by, but not limited to: (1) the number of personnel to occupy the building, (2) job functions and related furniture/office equipment to support the job function, (3) room functions, (4) rank and grade. Present original sets of the scheme to reviewers at an interim design conference upon completion of the interim architectural submittal or three months prior to the submittal of the final FF&E package (whichever comes first).

Design may proceed to final with the FF&E scheme presented at the conclusion of the interim phase, after resolutions to the comments have been agreed upon between DOR and Government reviewers.

Provide six copies of the electronic versions of all documents upon completion of the final architectural submittal or ten months prior to the contract completion date (whichever comes first), to ensure adequate time for furniture acquisition. Provide unbound, electronic drawings in CAD and BIM. Provide all files needed to view complete drawings. Submit all text documents in Microsoft Word or Excel..

Submit four copies of the final and complete FF&E information and samples in 8 ½" x 11" format using three ring binders with pockets on the inside of the cover upon completion of the final architectural submittal or ten months prior to the contract completion date (whichever comes first). Use more than one binder when there are numerous pages with thick samples. Large D-ring binders are preferred to O-ring binders. Use page protectors that are strong enough to keep pages from tearing out for upholstery and finish boards. Anchor large or heavy samples with mechanical fasteners, Velcro, or double-faced foam tape rather than rubber cement or glue. Fold out items must have a maximum spread of 25 ½". Provide cover and spine inserts sheets identifying the document as "Furniture, Fixtures & Equipment" package and include the project title and location, project number, Contractor/A/E name and phone number(s), submittal stage and date.

Provide electronic copies of all documents upon completion of the final architectural submittal or ten months prior to the contract completion date (whichever comes first), to ensure adequate time for furniture acquisition. Provide six compact disks with all drawings files needed to view the complete drawings unbound and in the latest version AutoCAD. Provide six additional compact disks of all text documents in Microsoft Word or Excel.

Design submittal requirements include, but are not limited to:

### 1.1.1. Narrative of Interior Design Objectives

Provide a narrative description of the furniture, to include functional, safety and ergonomic considerations, durability, sustainability, aesthetics, and compatibility with the building design.

### 1.1.2. Furniture Order Form

Prepare one Furnishings Order Form for each item specified in the design. This form identifies all information required to order each individual item. In addition to the project name and location, project number, and submittal phase, the order form must include:

- (a) Furniture item illustration and code
- (b) Furniture item name
- (c) Job name, location, and date
- (d) General Services Administration (GSA) FSC Group, part, and section
- (e) GSA Contract Number, Special Item Number (SIN), and contract expiration date
- (f) Manufacturer, Product name and Product model number or National Stock Number (NSN)
- (g) Finish name and number (code to finish samples)
- (h) Fabric name and number, minimum Wyzenbeek Abrasion Test double rubs (code to fabric samples)
- (i) Dimensions
- (j) Item location by room number and room name
- (k) Quantity per room
- (l) Total quantity
- (m) Special instructions for procurement ordering and/or installation (if applicable)
- (n) Written Product Description: include a non-proprietary paragraph listing the salient features of the item to include but not limited to:
  - (1) required features and characteristics
  - (2) ergonomic requirements
  - (3) functional requirements
  - (4) testing requirements
  - (5) furniture style
  - (6) construction materials
  - (7) minimum warranty

The following is an example for “m” features and characteristics, ergonomic requirements and functional requirements:

Chair Description:

- (1) Mid-Back Ergonomic Task Chair
- (2) Pneumatic Gaslift; Five Star Base
- (3) Mesh Back; Upholstered Seat
- (4) Height and Width Adjustable Task Arms:

- a. Arm Height: 6" - 11" (+-1/2")
- b. Arm Width: 2" - 4" adjustment
- (5) Height Adjustable Lumbar Support
- (6) Adjustable Seat Height 16"-21" (+- 1")
- (7) Sliding Seat Depth Adjustment 15"-18" (+-1")
- (8) Standard Hard Casters (for carpeted areas)
- (9) Overall Measurements:
  - a. Overall width: 25" - 27"
  - b. Overall depth: 25" - 28"
- (10) Must have a minimum of the following adjustments (In addition to the above):
  - a. 360 Degree Swivel
  - b. Knee-Tilt with Tilt Tension
  - c. Back angle
  - d. Forward Tilt
  - e. Forward Tilt and Upright Tilt Lock

For projects with systems furniture, also provide a written description of the following minimum requirements:

- (1) Type furniture systems (panel, stacking panels, spine wall, desk based system, or a combination)
- (2) Minimum noise reduction coefficient (NRC)
- (3) Minimum sound transfer coefficient (STC)
- (4) Minimum flame spread and smoke development
- (5) UL testing for task lighting and electrical system
- (6) Panel widths and heights and their locations (this may be done on the drawings) Worksurface types and sizes (this may be done on the drawings)
- (7) Worksurface edge type
- (8) Varying panel/cover finish materials and locations (locations may be shown on the drawings)
- (9) Storage requirements
- (10) Keyboard requirements
- (11) Lock and keying requirements
- (12) Accessory components (examples: tack boards, marker boards, paper management)
- (13) Electrical and communication raceway requirement; type, capacity and location (base, beltline, below and/or above beltline)
- (14) Locations of communication cables (base, beltline, below and/or above beltline, top channel)
- (15) Types of electrical outlets
- (16) Types of communication jacks; provided and installed by others
- (17) Locations of electrical outlets and communication jacks (this may be done on the drawings)

- (18) Type of cable (examples: Cat. 5, Cat. 6, fiber optic; UTP or STP, etc.) system needs to support; provided and installed by others

1.1.3. Manufacturer & Alternate Manufacturer List

Provide a table consisting of all the major furniture items in the order forms and two alternate manufacturers for each item. ALTERNATE MANUFACTURER ITEMS MUST BE SELECTED FROM GSA SCHEDULE AND MEET ALL THE SALIENT FEATURES OF THE ORIGINALLY SPECIFIED ITEM. Provide manufacturer name, address, telephone number, product series and product name for each item and the two alternate items. Major furniture items include, but are not limited to, casegoods, furniture systems, seating, and tables. Organize matrix by item code and item name.

1.1.4. FF&E Procurement List

Provide a table that lists all FF&E furniture, mission unique equipment and building Contractor Furnished/Contractor Installed (CF/CI) items. Give each item a code and name and designate whether item will be procured as part of the FF&E furniture, mission unique equipment or the building construction contract. Use the item code to key all FF&E documents including location plans, color boards, data sheets, cost estimate, etc. Divide the FF&E package into different sections based on this listing, applies to order forms and cost estimates.

1.1.5. Points of Contact (POCs)

Provide a comprehensive list of POCs needed to implement the FF&E package. This would include but not be limited to appropriate project team members, using activity contacts, interior design representatives, construction contractors and installers involved in the project. In addition to name, address, phone, fax and email, include each contact's job function. Divide the FF&E package into different sections based on this listing, applies to order forms and cost estimates.

1.1.6. Color Boards

Provide color boards for all finishes and fabrics for all FF&E items. Finishes to be included but not limited to paint, laminate, wood finish, fabric, etc.

1.1.7. Itemized Furniture Cost Estimate

Provide an itemized cost estimate of furnishings keyed to the plans and specifications of products included in the package. This cost estimate should be based on GSA price schedules. The cost estimate must include separate line items for general contingency, installation, electrical hook-up for systems furniture or other furniture requiring hardwiring by a licensed electrician, freight charges and any other related costs. Installation and freight quotes from vendors should be used in lieu of a percentage allowance when available. Include a written statement that the pricing is based on GSA schedules. An estimate developed by a furniture dealership may be provided as support information for the estimate, but must be separate from the contractor provided estimate.

1.2. INTERIOR DESIGN DOCUMENTS

1.2.1. Overall Furniture and Area Plans

Provide floor Plans showing locations and quantities of all freestanding, and workstation furniture proposed for each floor of the building. Key each room to a large scale Furniture Placement Plan showing the furniture configuration, of all furniture. Provide enlarged area plans with a key plan identifying the area in which the building is located. Key all the items on the drawings by furniture item code. Do not provide manufacturer specific information such as product names and numbers on drawings, Drawings shall be non-proprietary. This is typical for FFE on all plans, including those

mentioned below. Coordinate the overall furniture and area plans with the Life Safety Code Review to ensure adequate clearances are provided for egress. Provide a narrative of this coordination to accompany the Furniture and Area plans.

#### 1.2.2. Workstation Plans

Show each typical workstation configuration in plan view. In addition, provide either elevations or an isometric view. Drawings shall illustrate panels and all major components for each typical workstation configuration. Identify workstations using the same numbering system as shown on the project drawings. Key components to a legend on each sheet which identifies and describes the components along with dimensions. Provide the plan, elevations and isometric of each typical workstation together on the same drawing sheet.

#### 1.2.3. Panel Plans

Show panel locations and critical dimensions from finished face of walls, columns, panels including clearances and aisle widths. Key panel assemblies to a legend which shall include width, height, configuration of frames, panel fabric and finishes (if there are different selections existing within a project), powered or non-powered panel and wall mount locations.

#### 1.2.4. Desk Plans

Provide typical free standing desk configurations in plan view. In addition, provide either elevation or an isometric view and identify components to clearly represent each desk configuration.

#### 1.2.5. Reflected Ceiling Plans

Provide typical plans showing ceiling finishes and heights, lighting fixtures, heating ventilation and air conditioning supply and return, and sprinkler head placement for coordination of furniture.

#### 1.2.6. Electrical and Telecommunication Plans

Show power provisions including type and locations of feeder components, activated outlets and other electrical components. Show locations and quantities of outlets for workstations. Clearly identify different outlets, i.e. electrical, LAN and telecommunication receptacles indicating each type proposed. Show wiring configuration, (circuiting, switching, internal and external connections) and provide as applicable.

#### 1.2.7. Artwork Placement Plans

Provide an Artwork Placement Plan to show location of artwork, assign an artwork item code to each piece of artwork. As an alternative, artwork can be located on the Furniture Plans. Provide a schedule that identifies each piece by room name and number. Provide installation instructions; include mounting height.

#### 1.2.8. Window Drapery Plans

Provide Interior Window Drapery Plans. Key each drapery treatment to a schedule showing color, pattern, material, drapery size and type, draw direction, location and quantities.

#### 1.2.9. Portable Fire extinguishers:

Provide a list of all required portable fire extinguishers, with descriptions (location, size, type, etc.) and total number per type. See also attachment D, "SAMPLE FIRE PROTECTION AND LIFE SAFETY CODE REVIEW", paragraph 1.14.

### 1.3. FURNITURE SELECTION

1.3.1. Select furniture from the GSA Schedules. Specify furniture available open market when an item is not available on the GSA Schedules. Provide justification for items not available on the GSA Schedules.

1.3.2. To the greatest extent possible when specifying furniture work within a manufacturer's family of furniture for selections, example: Steelcase, Turnstone, Brayton International, Metro, and Vecta are all Steelcase companies. Each alternate should also be specified from a manufacturer's family of furniture, example: first set of alternates would be specified from Knoll's family of furniture and the second from Herman Miller family of furniture. It may be necessary to make some selections from other than a manufacturer's family of furniture if costs are not reasonable for particular items, some items are not available or appropriate for the facility or the items are not on GSA Schedule. If this occurs, consider specifying product from an open line that is accessible by numerous dealerships. Select office furniture including case goods, tables, storage, seating, etc. that is compatible in style, finish and color. Select furniture that complies with ANSI/BIFMA and from manufacturer's standard product line as shown in the most recent published price list and/or amendment and not custom product.

### 1.4. CONSTRUCTION

1.4.1. Provide knee space at workstations and tables that is not obstructed by panels/legs that interfere with knee space of seated person and specify modesty panels at walls to be of a height or be hinged to allow access to building wall electrical outlets and communication jacks. Provide desks, storage and tables with leveling devices to compensate for uneven floors.

1.4.2. Unless otherwise noted, specify workstations and storage of steel construction. Provide high pressure laminate worksurface tops constructed to prevent warpage (thermally fused worksurfaces are not acceptable). Provide user friendly features such as radius edges. Do not use sharp edges and exposed connections and ensure the underside of desks, tables and worksurfaces are completely and smoothly finished. Provide abutting worksurfaces that mate closely and are of equal heights when used in side-by-side configurations in order to provide a continuous and level worksurface.

1.4.3. Drawers shall stay securely closed when in the closed position and protect wires from damage during drawer operation. Include a safety catch to prevent accidental removal when fully open

1.4.4. Unless otherwise noted, provide lockable desks and workstations, filing cabinets and storage. Key all locks within a one person office the same; key all one person offices within a building differently. If an office or open office area has more than one workstation, key all the workstations differently, but key all locks within an individual workstation the same. Use tempered glass glazing when glazing is required. Use light-emitting diode (LED)/solid state lighting where task lighting is required in furniture.

### 1.5. FINISHES AND UPHOLSTERY

1.5.1. Specify neutral colors for casegoods, furniture systems, storage and tables. Specify desk worksurfaces and table tops that are not too light or too dark in color and have a pattern to help hide soiling. Accent colors are allowed in break and lounge areas. Keep placement of furniture systems panel fabric accent colors to a minimum. All finishes shall be cleanable with ordinary household cleaning solutions.

1.5.2. Use manufacturer's standard fabrics; including textile manufacturers fabrics that have been graded into the furniture manufacturers fabric grades and are available through their GSA Schedule. Customers Own Material (COM) can be used in headquarter buildings in command suites with executive furniture. Coordinate specific locations with Corps of Engineers Interior Designer.

1.5.3. Specify seating upholstery that meets Wyzenbeek Abrasion Test, 55,000 minimum rubs. Specify a soil retardant finish for woven fabrics if Crypton or vinyl upholstery is not provided for seating in dining areas. Use manufacturer's standard fabrics. This includes textile manufacturers fabrics that have been graded into the furniture manufactures fabric grades and are available through their GSA Schedule. Specify upholstery and finish colors and patterns that help hide soiling. Specify finishes that can be cleaned with ordinary household cleaning solutions.

## 1.6. ACCESSORIES

1.6.1. Specify all accessories required for completely finished furniture installation. Provide filing cabinets and storage for office supplies. Provide tack surfaces at workstations with overhead storage. Provide tackable surfaces at workstations with overhead storage.

1.6.2. Not Used.

1.6.3. Workstations are to be equipped with stable keyboard trays that have height adjustability, tilting capability, including negative tilt, have a mouse pad at same height as the keyboard tray that can accommodate both left and right handed users, and retractable under worksurface.

## 1.7. MISSION UNIQUE EQUIPMENT

Funding for FF&E furniture items and mission unique equipment (MUE) items are from two different sources. Separate the designs and procurement documentation for FFE items and MUE. MUE includes, but is not limited to, items such as commercial appliances, fitness equipment, IT equipment and supporting carts. The User will purchase and install mission unique equipment items, unless otherwise noted. Identify locations of known MUE items such as commercial appliances, etc. for space planning purposes.

## 1.8. SUSTAINABILITY

1.8.1. For all designs provided regardless of facility type, make every effort to implement all aspects of sustainability to the greatest extent possible for all the selections made in the FF&E package. This includes but is not limited to the selection of products that consider: **Material Chemistry and Safety of Inputs** (What chemicals are used in the construction of the selections?); **Recyclability** (Do the selections contain recycled content?); **Disassembly** (Can the selections be disassembled at the end of their useful life to recycle their materials?).

1.8.2. Make selections to the greatest extent possible of products that possess current McDonough Braungart Design Chemistry ([MBDC](#)) certification or other "third-party" certified Cradle to Cradle program, Forest Stewardship Council (FSC) certification, GREENGAURD certification or similar "third-party" certified products consisting of low-emitting materials.

## 1.9. FURNITURE SYSTEMS

1.9.1. General.

Where appropriate, design furniture systems in open office areas. Coordinate style and color of furniture systems with other storage, seating, etc. in open office areas. Minimize the number of workstation typicals and the parts and pieces required for the design to assist in future reconfiguration and inventorying.

1.9.2. Connector Systems.

Specify a connector system that allows removal of a single panel or spine wall within a typical workstation configuration without requiring disassembly of the workstation or removal of adjacent panels. Specify



connector system with tight connections and continuous visual seals. When Acoustical panels are used, provide connector system with continuous acoustical seals. Specify concealed clips, screws, and other construction elements, where possible.

#### 1.9.3. Panels and Spine Walls

Specify panels and spine walls with hinged or removable covers that permit easy access to the raceway when required but are securely mounted and cannot be accidentally dislodged under normal conditions. Panels shall be capable of structurally supporting more than 1 fully loaded component per panel per side. Raceways are to be an integral part of the panel and must be able to support lay-in cabling and have a large capacity for electrical and IT. Do not thread cables through the frame.

#### 1.9.4. Electrical And Information/Technology (IT)

Design furniture with electrical systems that meets requirements of UL 1286 when powered panels are required and UL approved task lights that meet requirements of NFPA 70. Dependent on user requirements and Section 01 10 00, paragraph 3 requirements, it is recommended that workstation electrical and IT wiring entry come from the building walls to eliminate the use of power poles and access at the floor. Design electrical and IT systems that are easily accessed in the spine wall and panels without having to move return panels and components. Electrical and IT management will be easily accessible by removable wall covers which can be removed while workstation components are still attached. Specify connector system that has continuation of electrical and IT wiring within workstations and workstation to workstation.

#### 1.9.5. Pedestals

Specify pedestals that are interchangeable from left to right, and right to left, and retain pedestal locking system capability.

### 1.10. EXECUTIVE FURNITURE

1.10.1. Design for executive furniture in command areas, coordinate specific locations with Corps of Engineers Interior Designer. Use upgraded furniture, upholsteries and finishes in command suites. This includes but is not limited to wood casegoods, seating and tables. Select executive furniture casegoods from a single manufacturer and style line, to include workstations, credenzas, filing, and storage, etc.

1.10.2. Specify furniture with wood veneer finish with mitered solid wood edge of same wood type. Other executive office furniture such as seating, tables, executive conference room furniture, etc. shall be compatible in style, finish and color with executive furniture casegoods.

### 1.11. SEATING

#### 1.11.1. General

Specify appropriate chair casters and glides for the floor finish where the seating is located. All task seating shall support up to a minimum of 250 lbs.

#### 1.11.2. Desk and Guest Seating

Select ergonomic desk chairs with casters, waterfall front, swivel, tilt, variable back lock, adjustable back height or adjustable lumbar support, pneumatic seat height adjustment, and padded, contoured upholstered seat and back. Desk and guest chair backs may be other than upholstered such as mesh fabric if it is ergonomically designed, forms to back and is comfortable. Depending on scale of desk chair provide seat pan forward and back adjustment to increase or decrease depth of seat pan. All desk chairs

shall have an adjustable seat height range of 4 1/2", range to include 16 1/2-20". Select guest chairs that are compatible in style, finish and color with the desk chairs.

#### 1.11.3. Conference Room Seating

At tables, select ergonomic conference seating with casters, non-upholstered arms, waterfall front, swivel, tilt, pneumatic seat height adjustment, and padded, contoured seat and back, unless otherwise noted. Select arm height and/or design that allows seating to be moved up closely to the table top. Conference chair backs may be other than upholstered such as mesh fabric if it is ergonomically designed, forms to back and is comfortable. Perimeter conference chairs shall be compatible in style, finish and color with conference seating at the tables.

#### 1.11.4. Lounge, Waiting and Reception Area Seating

Select seating with arms and cushioned, upholstered seat and back. In heavy use areas, arms shall be easily cleaned such as non-upholstered arms or upholstered arms with wood arm caps unless otherwise noted.

#### 1.11.5. Break Room Seating

Select stackable seating that is easily cleaned. Seating shall be appropriate for table and counter heights as applicable with non-upholstered arms if arms are required. Chairs shall have metal legs and composite materials for seats.

#### 1.12. FILING AND STORAGE.

Select storage and shelving units that meet customer's functional load requirements for stored items. Specify counterweights for filing cabinets when required by the manufacturer for stability. File drawers shall allow only one drawer to be opened at a time. Provide heavy duty storage and shelving if information is not available.

#### 1.13. TRAINING TABLES.

training tables shall be reconfigurable, moveable and storable; lighter weight folding with dollies or casters as necessary. Plastic laminate self edges are unacceptable. Specify power and data requirements and dollies as required.

#### 1.14. FURNITURE WARRANTIES.

Specify manufacturer's performance guarantees or warranties that include parts, labor and transportation as follows:

Furniture System, unless otherwise noted – 10 year minimum  
Furniture System Task Lights – 2 year minimum, excluding bulbs  
Furniture System Fabric – 3 year minimum  
Wood Desks - 10 year minimum

Metal Desks – 12 year minimum  
Seating, unless otherwise noted - 10 year minimum  
Seating Mechanisms and Pneumatic Cylinders - 10 years  
Seating Fabric - 3 years minimum  
Wood Filing and Storage - 10 year minimum

Tables, unless otherwise noted - 10 year minimum  
Table Mechanisms – 5 year minimum

Table Ganging Device - 1 year minimum  
Items not listed above - 1 year minimum

## **ATTACHMENT C TRACKING COMMENTS IN DRCHECKS**

### **1.0 General**

The Government and DB Contractor shall set up the project in Dr Checks. Throughout the design process, the parties shall enter, track, and back-check comments using the DrChecks system. Government and Contractor reviewers enter design review comments into DrChecks. Designers of Record shall annotate comments timely and specifically to indicate for the review conference exactly what action will be taken or why the action is not required. After the design review conference and prior to the next design submittal for the package, the DOR's will annotate those comments that require DOR action, design revision, etc. to show how and where it has been addressed in the design documents, This shall be part of the required design configuration management plan. Comments considered critical by the conference participants shall be flagged as such.

### **2.0 DrChecks Review Comments**

The Contractor and the Government shall monitor DrChecks to assure all comments are annotated and resolved prior to the next submittal. Print and include the DrChecks comments and responses and included in the design analysis for record in the next design submittal for that package.

2.1. Upon review of comments prior to the design review conference, the DOR(s) shall identify whether they concur, non-concur, mark it "for information only" or mark it "check and resolve". Indicate exactly what action will be taken or why the action is not required.

2.2. Conference participants (reviewers) will expect coordination between Design Analysis calculations and the submitted design. Reviewers will also focus on the design submittal's satisfaction of the contract requirements.

2.3. After the conference, the DOR(s) shall formally respond to each applicable comment in DrChecks a second time prior to the next submittal, clearly indicating what action was taken and what drawing/spec/design analysis changed. Designers of Record are encouraged to directly contact reviewers to discuss and agree to the formal comment responses rather than relying only on DrChecks and review meetings to discuss comments. With the next submittal, reviewers will back-check answers to the comments against the new submittal, in addition to reviewing additional design work.

2.4. Clearly annotate in DrChecks those comments that, in the DB Contractor's opinion, require effort outside the scope of the contract. Do not proceed with work outside the contract until a modification to the contract is properly executed, if one is necessary.

### **3.0 DrChecks Initial Account Set-Up**

To initialize an office's use of DrChecks, choose a contact person within the office to call the DrChecks Help Desk at 800-428-HELP, M-F, 8AM-5PM, Central time. This POC will be given an office password to distribute to others in the office. Individuals can then go to the hyperlink at <http://www.projnet.org> and register as a first time user. Upon registration, each user will be given a personal password to the DrChecks system.

3.1. Once the office and individuals are registered, the COE's project manager or lead reviewer will assign the individuals and/or offices to the specific project for review. At this point, persons assigned can make comments, annotate comments, and close comments, depending on their particular assignment.

### **4.0 DrChecks Reviewer Role**

The Contractor is the technical reviewer and the Government is the compliance reviewer of the DB's design documents. Each reviewer enters their own comments into the Dr Checks system. To enter comments:

- 4.1. Log into DrChecks.
- 4.2. Click on the appropriate project.
- 4.3. Click on the appropriate review conference. An Add comment screen will appear.
- 4.4. Select or fill out the appropriate sections (particularly comment discipline and type of document for sorting) of the comment form and enter the comment in the space provided.
- 4.5. Click the Add Comment button. The comment will be added to the database and a fresh screen will appear for the next comment you have.
- 4.6. Once comments are all entered, exit DrChecks by choosing "My Account" and then Logout.

#### **5.0 DrChecks Comment Evaluation (Step 1 of 2)**

The role of the DOR(s) is to evaluate and respond to the comments entered by the Government's and DB Contractor's reviewers. To respond to comments:

- 5.1. Log into DrChecks.
- 5.2. Click on the appropriate project.
- 5.3. Under "Evaluate" click on the number under "Pending".
- 5.4. Locate the comments that require your evaluation. (Note: If you know the comment number you can use the Quick Pick window on your home page in DrChecks; enter the number and click on go.)
- 5.5. Select the appropriate evaluation radio button (concur, non-concur, for information only, or check and resolve) and respond with a brief explanation in the Discussion field. An explanation other than to say "concur" is not necessary for "Concur", but may be useful for the Design Configuration Management purposes.
- 5.6. Click on the Add button. The evaluation will be added to the database and a fresh screen will appear with the next comment.
- 5.7. Once evaluations are all entered, exit DrChecks by choosing "My Account" and then Logout.

#### **6.0 DrChecks Comment Evaluation (Step 2 of 2)**

This is where the DOR(s) respond to each applicable comment in DrChecks after the design review conference, prior to the next submittal, clearly indicating what action was taken and what drawing/spec/design analysis changed. Respond to the previous comments, following the same steps as above, adding the narrative in the discussion field.

#### **7.0 DrChecks Back-Check**

At the following design conference, (where applicable) or at some other agreed time, Government and Contractor reviewers will back-check comment annotations against newly presented documents to verify that the designers' responses are acceptable and that all revisions have been completed. Reviewers

shall either enter additional back-check comments, if necessary, or close those where actions are complete.

- 7.1. Log into DrChecks.
- 7.2. Click on the appropriate project.
- 7.3. Under "My Backcheck" click on the number under "Pending".
- 7.4. If you agree with the designer's response select "Close Comment" and add a closing response if desired.
- 7.5. If you do not agree with the designer's response or the submittal does not reflect the response given, select "Issue Open", enter additional information.
- 7.6. Click on the Add button. The back-check will be added to the database and a fresh screen will appear with the next comment.
- 7.7. Once back-checks are all entered, exit DrChecks by choosing "My Account" and then Logout. The design is completed and final when there are no pending comments to be evaluated and there are no pending or open comments under back-check.

**ATTACHMENT D**  
**SAMPLE FIRE PROTECTION AND LIFE SAFETY CODE REVIEW**

Instructions: Use the information outlined in this document to provide the minimum requirement for development of Fire Protection and Life Safety Code submittals for all building projects. Additional and supplemental information may be used to further develop the code review. Insert N/A after criteria, which may be "not applicable".

**1.0 SAMPLE FIRE PROTECTION AND LIFE SAFETY CODE REVIEW**

- 1.1. Project Name (insert name and location)
- 1.2. Applicable Codes and Standards
  - 1.2.1. Unified Facilities Criteria (UFC): 3-600-01, Design: Fire Protection Engineering For Facilities
  - 1.2.2. International Building Code (IBC) for fire resistance requirements, allowable floor area, building height limitations and building separation distance requirements, except as modified by UFC 3-600-01.
  - 1.2.3. National Fire Protection Association (NFPA) 101 Life Safety Code (latest edition), for building egress and life safety and applicable criteria in UFC 3-600-01.
  - 1.2.4. ADA and ABA Accessibility Guidelines. For Buildings and Facilities See Section 01 10 00, Paragraph 3 for facility specific criteria.
- 1.3. Occupancy Classification  
IBC chapters 3 and 4
- 1.4. Construction Type  
IBC chapter 6
- 1.5. Area Limitations  
IBC chapter 5, table 503
- 1.6. Allowable Floor Areas  
IBC section 503, 505
- 1.7. Allowable area increases  
IBC section 506, 507
- 1.8. Maximum Height of Buildings  
IBC section 504
- 1.9. Fire-resistive substitution
- 1.10. Occupancy Separations  
IBC table 302.3.2
- 1.11. Fire Resistive Requirements
  - 1.11.1. Exterior Walls - [ ] hour rating, IBC table 601, 602

- 1.11.2. Interior Bearing walls - [ ] hour rating
- 1.11.3. Structural frame - [ ] hour rating
- 1.11.4. Permanent partitions - [ ] hour rating
- 1.11.5. Shaft enclosures - [ ] hour rating
- 1.11.6. Floors & Floor-Ceilings - [ ] hour rating
- 1.11.7. Roofs and Roof Ceilings - [ ] hour rating
- 1.12. Automatic Sprinklers and others used to determine the need for automatic Extinguishing Equipment, Extinguishing Systems, Foam Systems, Standpipe
  - 1.12.1. UFC 3-600-01, chapters 4 and 6 systems, wet chemical systems, etc. State which systems are required and to what criteria they will be designed.
  - 1.12.2. UFC 3-600-01, Appendix B Occupancy Classification. Note the classification for each room. This may be accomplished by classifying the entire building and noting exceptions for rooms that differ (E.g. The entire building is Light Hazard except boiler room and storage rooms which are [ ], etc.)
  - 1.12.3. UFC 3-600-01, Chapter 3 Sprinkler Design Density, Sprinkler Design Area, Water Demand for Hose Streams (supply pressure and source requirements).
  - 1.12.4. UFC 3-600-01, Chapter 4 Coverage per sprinkler head. Extended coverage sprinkler heads are not permitted.
  - 1.12.5. Available Water Supply. Provide the results of the water flow tests showing the available water supply static pressure and residual pressure at flow. Based on this data and the estimated flow and pressure required for the sprinkler system, determine the need for a fire pump.
  - 1.12.6. NFPA 13, Para. 8.16.4.6.1. Provide backflow preventer valves as required by the local municipality, authority, or water purveyor. Provide a test valve located downstream of the backflow preventer for flow testing the backflow preventer at full system demand flow. Route the discharge to an appropriate location outside the building.
- 1.13. Kitchen Cooking Exhaust Equipment

Describe when kitchen cooking exhaust equipment is provided for the project. Type of extinguishing systems for the equipment should be provided. per NFPA 96. Show all interlocks with manual release switches, fuel shutoff valves, electrical shunt trips, exhaust fans, and building alarms.
- 1.14. Portable Fire Extinguishers, fire classification and travel distance. per NFPA 10
- 1.15. Enclosure Protection and Penetration Requirements. - Opening Protectives and Through Penetrations
  - 1.15.1. IBC Section 712, 715 and Table 715.3. Mechanical rooms, exit stairways, storage rooms, janitor [ ] hour rating. IBC Table 302.1.1
  - 1.15.2. Fire Blocks, Draft Stops, Through Penetrations and Opening Protectives
- 1.16. Fire Dampers. Describe where fire dampers and smoke dampers are to be used (IBC Section 716 and NFPA 90A). State whether isolation smoke dampers are required at the air handler.



- 1.17. Detection Alarm and Communication. UFC 3-600-01, (Chapter 5); NFPA 101 para. 3.4 (chapters 12-42); NFPA 72
- 1.18. Mass Notification. Describe building/facility mass notification system (UFC 4-021-01) type and type of base-wide mass notification/communication system. State whether the visible notification appliances will be combined with the fire alarm system or kept separate. (Note: Navy has taken position to combine visible notification appliances with fire alarm).
- 1.19. Interior Finishes (classification). NFPA 101.10.2.3 and NFPA 101.7.1.4
- 1.20. Means of Egress
- 1.20.1. Separation of Means of Egress, NFPA 101 chapters 7 and 12-42; NFPA101.7.1.3
- 1.20.2. Occupant Load, NFPA101.7.3.1 and chapters 12-42.
- 1.20.3. Egress Capacity (stairs, corridors, ramps and doors) NFPA101.7.3.3
- 1.20.4. Number of Means of Egress, NFPA101.7.4 and chapters 12-42.
- 1.20.5. Dead end limits and Common Path of Travel, NFPA 101.7.5.1.6 and chapters 12-42.
- 1.20.6. Accessible Means of Egress (for accessible buildings), NFPA101.7.5.4
- 1.20.7. Measurement of Travel Distance to Exits, NFPA101.7.6 and chapters 12-42.
- 1.20.8. Discharge from Exits, NFPA101.7.7.2
- 1.20.9. Illumination of Means of Egress, NFPA101.7.8
- 1.20.10. Emergency Lighting, NFPA101.7.9
- 1.20.11. Marking of Means of Egress, NFPA101.7.10
- 1.21. Elevators, UFC 3-600-01, Chapter 6; IBC and ASME A17.1 - 2000,(Safety Code for Elevators and Escalators)
- 1.22. Accessibility Requirements, ADA and ABA Accessibility Guidelines for Buildings and Facilities
- 1.23. Certification of Fire Protection and Life Safety Code Requirements. (Note: Edit the Fire team membership if necessary). Preparers of this document certify the accuracy and completeness of the Fire Protection and Life Safety features for this project in accordance with the attached completed form(s).
- 1.24. Designer of Record. Certification of Fire protection and Life Safety Code Requirements. (Note: Edit the Fire team members if necessary). Preparers of this document certify the accuracy and completeness of the Fire Protection and Life Safety features of this project.

Fire Protection Engineer of Record:

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Signature and Stamp

Date

OR

Architect of Record:

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Signature and Stamp

Date

Mechanical Engineer of Record:

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Signature and Stamp

Date

Electrical Engineer of Record:

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Signature/Date

**ATTACHMENT E  
LEED SUBMITTALS**

LEED Credit Paragraph	Contractor Check Here if Credit is Claimed	LEED-NC v3 Submittals (OCT09)	Provide for Credit Audit Only	REQUIRED DOCUMENTATION	DATE	REV
PAR		FEATURE	DUE AT			
<b>GENERAL</b>						
GENERAL - All calculations shall be in accordance with LEED 2009 Reference Guide.						
GENERAL: Obtain excel version of this spreadsheet at <a href="http://en.sas.usace.army.mil/enWeb/EngineeringCriteria">http://en.sas.usace.army.mil/enWeb/EngineeringCriteria</a> .						
GENERAL - For all credits, narrative/comments may be added to describe special circumstances or considerations regarding the project's credit approach.						
GENERAL - Include all required LEED drawings indicated below in contract drawings with applicable discipline drawings, labeled For Reference Only.						
NOTE: Each submittal indicated with "****" differs from LEED certified project submittals by either having a different due date or being an added submittal not required by GBCI.						
NOTE: Projects seeking LEED certification need only submit to GBCI whatever documentation is acceptable to GBCI (for example, licensed professional certifications). This checklist identifies what must be submitted to the Government for internal review purposes. Government review of LEED documentation in no way supercedes or modifies the requirements and rulings of GBCI for purposes of compliance with project requirement to obtain LEED certification.						
GENERAL - Audit documentation may include but is not limited to what is indicated in this table.						
			Closeout	List of all Final Design submittals revised after final design to reflect actual closeout conditions. Revised Final Design submittals. - OR - Statement confirming that no changes have been made since final design that effect final design submittal documents.		Proj Engr (PE)
<b>CATEGORY 1 - SUSTAINABLE SITES</b>						
SSPR1		Construction Activity Pollution Prevention (PREREQUISITE)	**Final Design	List of drawings and specifications that address the erosion control, particulate/dust control and sedimentation control measures to be implemented.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			**Final Design	Narrative that indicates which compliance path was used (NPDES or Local standards) and describes the measures to be implemented on the project. If a local standard was followed, provide specific information to demonstrate that the local standard is equal to or more stringent than the NPDES program.		CIV
SS1		Site Selection	Final Design	Statement confirming that project does not meet any of the prohibited criteria.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design	LEED Site plan drawing that shows all proposed development, line depicting boundary of all bodies of water and/or wetlands within 100 feet of project boundary and a line depicting 5' elevation above 100 year flood line that falls within project boundary. Not required if neither condition applies.		CIV
SS2		Development Density & Community Connectivity	Final Design	Option 1: LEED Site vicinity plan showing project site and surrounding development. Show density boundary or note drawing scale.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design	Option 1: Table indicating, for project site and all surrounding sites within density radius (keyed to site vicinity plan), site area and building area. Project development density calculation. Density radius calculation. Development density calculation within density radius.		CIV
			Final Design	Option 2: LEED Site vicinity plan showing project site, the 1/2 mile community radius, pedestrian walkways and the locations of the residential development(s) and Basic Services surrounding the project site.		CIV
			Final Design	Option 2: List (including business name and type) of all Basic Services facilities within the 1/2 mile radius, keyed to site vicinity plan.		CIV
SS3		Brownfield Redevelopment	Final Design	Narrative describing contamination and the remediation activities included in project. Include statement indicating how site was determined to be a brownfield.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
SS4.1		Alternative Transportation: Public Transportation Access	Final Design	Statement indicating which option for compliance applies. State whether public transportation is existing or proposed and, if proposed, cite source of this information.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design	Option 1: LEED Site vicinity plan showing project site, mass transit stops and pedestrian path to them with path distance noted.		CIV
			Final Design	Option 2: LEED Site vicinity plan showing project site, bus stops and pedestrian path to them with path distance noted.		CIV
SS4.2		Alternative Transportation: Bicycle Storage & Changing Rooms	Final Design	FTE calculation. Bicycle storage spaces calculation. Shower/changing facilities calculation.		CIV
			Final Design	List of drawings that show the location(s) of bicycle storage areas. Statement indicating distance from building entrance.		CIV
			Final Design	List of drawings that show the location(s) of shower/changing facilities and, if located outside the building, statement indicating distance from building entrance.		ARC

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SS4.3		Alternative Transportation: Low Emitting & Fuel Efficient Vehicles	Final Design	Statement indicating which option for compliance applies. FTE calculation. Statement indicating total parking capacity of site.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design	Option 1: Low-emission & fuel-efficient vehicle calculation.		CIV
			Final Design	Option 1: List of drawings and specification references that show location and number of preferred parking spaces for low-emission & fuel-efficient vehicles and signage.		CIV
			Final Design	Option 1: Statement indicating quantity, make, model and manufacturer of low-emission & fuel-efficient vehicles to be provided. Statement confirming vehicles are zero-emission or indicating ACEEE vehicle scores.		CIV
			Final Design	Option 2: Low-emission & fuel-efficient vehicle parking calculation.		CIV
			Final Design	Option 2: List of drawings and specification references that show location and number of preferred parking spaces and signage.		CIV
			Final Design	Option 3: Low-emission & fuel-efficient vehicle refueling station calculation.		CIV
			Final Design	Option 3: List of drawings and specifications indicating location and number of refueling stations, fuel type and fueling capacity for each station for an 8-hour period.		CIV
			Closeout	Option 3: Construction product submittals indicating what was provided and confirming compliance with respect to fuel type and fueling capacity for each station for an 8-hour period.		CIV
SS4.4		Alternative Transportation: Parking Capacity	Final Design	Statement indicating which option for compliance applies.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design	Option 1: Preferred parking calculation including number of spaces required, total provided, preferred spaces provided and percentage.		CIV
			Final Design	Option 2: FTE calculation. Preferred parking calculation including number of spaces provided, preferred spaces provided and percentage.		CIV
			Final Design	Options 1 and 2: List of drawings and specification references that show location and number of preferred parking spaces and signage.		CIV
			Final Design	Option 3: Narrative indicating number of spaces required and provided and describing infrastructure and support programs with description of project features to support them.		CIV
SS5.1		Site Development: Protect or Restore Habitat	**Final Design	Option 1: List of drawing and specification references that convey site disturbance limits.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			**Final Design	Option 2: LEED site plan drawing that delineates boundaries of each preserved and restored habitat area with area (sf) noted for each.		CIV
			**Final Design	Option 2: Percentage calculation of restored/preserved habitat to total site area. List of drawings and specification references that convey restoration planting requirements.		CIV
SS5.2		Site Development: Maximize Open Space	Final Design	Option 2: LEED site plan drawing delineating boundary of vegetated open space adjacent to building with areas of building footprint and designated open space noted.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
SS6.1		Stormwater Design: Quantity Control	Final Design	Statement indicating which option for compliance applies.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design	Option 1: Indicate pre-development and post-development runoff rate(cfs) and runoff quantity (cf) -OR - Narrative describing site conditions, measures and controls to be implemented to prevent excessive stream velocities and erosion.		CIV
			Final Design	Option 2: Indicate pre-development and post-development runoff rate(cfs) and runoff quantity (cf). Indicate percent reduction in each.		CIV
SS6.2		Stormwater Design: Quality Control	Final Design	For non-structural controls, list all BMPs used and, for each, describe the function of the BMP and indicate the percent annual rainfall treated. List all structural controls and, for each, describe the pollutant removal and indicate the percent annual rainfall treated.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
SS7.1		Heat Island Effect: Non-Roof	**Final Design	LEED site plan drawing indicating locations and quantities of each paving type, including areas of shaded pavement. Percentage calculation indicating percentage of reflective/shaded/open grid area.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV

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SS7.2		Heat Island Effect: Roof	Final Design	Option 1: Percentage calculation indicating percentage of SRI compliant roof area. List of drawings and specification references that convey SRI requirements and roof slopes.		ARC
			Final Design	Option 1: List of specified roof materials indicating, for each, type, manufacturer, product name and identification if known, SRI value and roof slope.		ARC
			**Closeout	Option 1: List of installed roof materials indicating, for each, manufacturer, product name and identification, SRI value and roof slope.		PE
			Closeout	X Option 1: Manufacturer published product data or certification confirming SRI		PE
			Final Design	Option 2: Percentage calculation indicating percentage of vegetated roof area.		ARC
			Final Design	Option 3: Combined reflective and green roof calculation.		ARC
			Final Design	Option 3: List of specified roof materials indicating, for each, type, manufacturer, product name and identification if known, SRI value and roof slope.		ARC
			**Closeout	Option 3: List of installed roof materials indicating, for each, manufacturer, product name and identification, SRI value and roof slope.		PE
			Closeout	X Option 3: Manufacturer published product data or certification confirming SRI		PE
SS8		Light Pollution Reduction	Final Design	Interior Lighting: List of drawings and specification references that convey interior lighting requirements (location and type of all installed interior lighting, location of non-opaque exterior envelope surfaces, allowing confirmation that maximum candela value from interior fixtures does not intersect non-opaque building envelope surfaces). - OR - List of drawings and specification references that show automatic lighting controls compliance with credit requirement.		ELEC
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		ELEC
			Final Design	Exterior Lighting: List of drawings and specification references that convey exterior lighting requirements (location and type of all site lighting and building façade/landscape lighting).		ELEC
			Final Design	Exterior Site Lighting Power Density (LPD): Tabulation for exterior site lighting indicating, for each location identification or description, units of measure, area or distance of the location, actual LPD using units consistent with ASHRAE 90.1, and the ASHRAE allowable LPD for that type of location. Percentage calculation of actual versus allowable LPD for all site lighting.		ELEC
			Final Design	Exterior Building Facade/Landscape Lighting Power Density (LPD): Tabulation for exterior building facade/landscape lighting indicating, for each location identification or description, units of measure, area or distance of the location, actual LPD using units consistent with ASHRAE 90.1, and the ASHRAE allowable LPD for that type of location. Percentage calculation of actual versus allowable LPD for all building facade/landscape lighting.		ELEC
			Final Design	Exterior Lighting IESNA Zone: Indicate which IESNA zone is applicable to the project.		ELEC
			Final Design	Exterior Lighting Site Lumen table indicating, for each fixture type, quantity installed, initial lamp lumens per luminaire, initial lamp lumens above 90 degrees from Nadir, total lamp lumens and total lamp lumens above 90 degrees. Percentage of site lamp lumens above 90 degrees from nadir to total lamp lumens.		ELEC
			Final Design	Exterior Lighting Narrative describing analysis used for addressing requirements for light trespass at site boundary and beyond.		ELEC
<b>CATEGORY 2 – WATER EFFICIENCY</b>						
WEPR1		Water Use Reduction: 20% Reduction	Final Design	Statement confirming which occupancy breakdown applies (default or special). For special occupancy breakdown, indicate source and explanation for ratio.		MEC
			Final Design	Occupancy calculation including male/female numbers for FTEs, visitors, students, customers, residential and other type occupants/users		MEC
			Final Design	Statement indicating percent of male restrooms with urinals. Statement indicating annual days of operation.		MEC

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			Final Design	Baseline flush fixture calculation spreadsheet indicating, for each fixture type, gender, flush rate, daily uses per person for each occupant type identified in occupancy calculation and annual baseline flush fixture water usage.		MEC
			Final Design	Design case flush fixture calculation spreadsheet indicating, for each fixture type, gender, fixture manufacturer, fixture model number, flush rate, percent of occupants using this fixture type, daily uses per person for each occupant type identified in occupancy calculation and annual design case flush fixture water usage.		MEC
			Closeout	X Manufacturer published product data or certification confirming fixture water usage.		PE
WE1.1		Water Efficient Landscaping: Reduce by 50%	Final Design	Statement indicating which option for compliance applies.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design	Calculation indicating, for baseline and design case, total water applied, total potable water applied, total non-potable water applied. Design case percent potable water reduction. If nonpotable water is used, indicate source of nonpotable water.		CIV
			Final Design	List of landscape plan drawings.		CIV
			Final Design	Narrative describing landscaping and irrigation design strategies, including water use calculation methodology used to determine savings and, if non-potable water is used, specific information about source and available quantity.		CIV
WE1.2		Water Efficient Landscaping: No Potable Water Use or No Irrigation	Same as WE1.1	Same as WE1.1		CIV
WE2		Innovative Wastewater Technologies	Final Design	Statement confirming which option for compliance applies.		MEC
			Final Design	Statement confirming which occupancy breakdown applies (default or special). For special occupancy breakdown, indicate source and explanation for ratio.		MEC
			Final Design	Occupancy calculation including male/female numbers for FTEs, visitors, students, customers, residential and other type occupants/users		MEC
			Final Design	Statement indicating percent of male restrooms with urinals. Statement indicating annual days of operation.		MEC
			Final Design	Baseline flush fixture calculation spreadsheet indicating, for each fixture type, gender, flush rate, daily uses per person for each occupant type identified in occupancy calculation and annual baseline flush fixture water usage.		MEC
			Final Design	Design case flush fixture calculation spreadsheet indicating, for each fixture type, gender, fixture manufacturer, fixture model number, flush rate, percent of occupants using this fixture type, daily uses per person for each occupant type identified in occupancy calculation and annual design case flush fixture water usage.		MEC
			Final Design	Option 1: If onsite non-potable water is used, identify source(s), indicate annual quantity from each source and indicate total annual quantity from all onsite non-potable water sources.		MEC
			Final Design	Option 1: Summary calculation indicating baseline annual water consumption, design case annual water consumption, non-potable annual water consumption and total percentage annual water savings.		MEC
			Final Design	Option 2: Statement confirming on-site treatment of all generated wastewater to tertiary standards and all treated wastewater is either infiltrated or used on-site.		MEC
			Final Design	Option 2: List of drawing and specification references that convey design of on-site wastewater treatment features.		CIV
			Final Design	Option 2: On-site water treatment quantity calculation indicating all on-site wastewater source(s), annual quantity treated, annual quantity infiltrated and annual quantity re-used on site from each source and totals for annual quantity treated, annual quantity infiltrated and annual quantity re-used on site from all sources.		CIV
			Final Design	Option 2: Wastewater summary calculation indicating design case annual flush fixture water usage, annual on-site water treatment and percentage sewage conveyance reduction.		MEC
			Final Design	Narrative describing project strategy for reduction of potable water use for sewage conveyance, including specific information on reclaimed water usage and treated wastewater usage.		MEC
WE3		Water Use Reduction: 30% - 40% Reduction	Same as WEPR1	Same as WEPR1		MEC
<b>CATEGORY 3 – ENERGY AND ATMOSPHERE</b>						

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EAPR1		Fundamental Commissioning of the Building Energy Systems (PREREQUISITE)	**Final Design	**Owner's Project Requirements document		ALL
			**Final Design	**Basis of Design document for commissioned systems		MEC, ELEC
			**Final Design	**Commissioning Plan		MEC, ELEC
			Closeout	Statement confirming all commissioning requirements have been incorporated into construction documents.		PE
			Closeout	Commissioning Report		PE
EAPR2		Minimum Energy Performance (PREREQUISITE)	Final Design	Statement listing the mandatory provisions of ASHRAE 90.1 that project meets relative to compliance with this prerequisite and indicating which compliance path was used.		MEC ELEC ARC
			Final Design	Statement indicating which compliance path option applies.		MEC
			Final Design	Option 1: Statement confirming simulation software capabilities and confirming assumptions and methodology.		MEC
			Final Design	Option 1: General information including simulation program, principal heating source, percent new construction and renovation, weather file, climate zone and Energy Star Target Finder score.		MEC
			Final Design	Option 1: Space summary listing, for each building use, the conditioned area, unconditioned area and total area and include total area for each category		MEC
			Final Design	Option 1: List of all simulation output advisory message data and show difference between baseline and proposed design		MEC
			Final Design	Option 1: Comparison summary for energy model inputs including description of baseline and design case energy model inputs, showing both by element type		MEC
			Final Design	Option 1: Energy type summary listing, for each energy type, utility rate description, units of energy and units of demand		MEC
			Final Design	Option 1: Statement indicating whether project uses on-site renewable energy. If yes, list all sources and indicate, for each source, backup energy type, annual energy generated, rated capacity and renewable energy cost		MEC
			Final Design	Option 1: If analysis includes exceptional calculation methods, statement describing how exceptional calculation measure cost savings is determined		MEC
			Final Design	Option 1: If analysis includes exceptional calculation methods, for each exceptional calculation method indicate energy types and, for each energy type, annual energy savings, annual cost savings, and brief descriptive narrative		MEC
			Final Design	Option 1: Baseline performance rating compliance report table indicating, for each energy end use, whether it is a process load, energy type, annual and peak energy demand for all four orientations. For each orientation indicate total annual energy use for each orientation and total annual process energy use.		MEC
			Final Design	Option 1: Baseline energy cost table indicating, for each energy type, annual cost for all four orientations and building total energy cost.		MEC
			Final Design	Option 1: Proposed Design performance rating compliance report table indicating, for each energy end use, whether it is a process load, energy type, annual and peak energy demand, baseline annual and peak energy demand and percent savings. Indicate total annual energy use and total annual process energy use for both proposed design and baseline and percent savings.		MEC
			Final Design	Option 1: Proposed Design energy cost table indicating, for each energy type, annual cost for all four orientations and building total energy cost.		MEC
			Final Design	Option 1: Energy cost and consumption by energy type report indicating, for each energy type, proposed design and baseline annual use and annual cost, percent savings annual use and annual cost. Indicate for renewable energy annual energy generated and annual cost. Indicate exceptional calculations annual energy savings and annual cost savings. Indicate building total annual energy use, annual energy cost for proposed design and baseline and indicate percent savings annual energy use and annual energy cost.		MEC



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			Final Design	Option 1: Compliance summaries from energy simulation software. If software does not produce compliance summaries provide output summaries and example input summaries for baseline and proposed design supporting data in the tables. Output summaries must include simulated energy consumption by end use and total energy use and cost by energy type. Example input summaries should represent most common systems and must include occupancy, use pattern, assumed envelope component sizes and descriptive features and assumed mechanical equipment types and descriptive features		MEC
			Final Design	Option 1: Energy rate tariff from project energy providers (only if not using LEED Reference Guide default rates)		MEC
EAPR3		Fundamental Refrigerant Management (PREREQUISITE)	Final Design	Statement indicating which option for compliance applies.		MEC
			Final Design	Option 2: Narrative describing phase out plan, including specific information on phase out dates and refrigerant quantities.		MEC
EA1		Optimize Energy Performance	Final Design	Statement indicating which compliance path option applies.		MEC
			Final Design	Option 1: Statement confirming simulation software capabilities and confirming assumptions and methodology.		MEC
			Final Design	Option 1: General information including simulation program, principal heating source, percent new construction and renovation, weather file, climate zone and Energy Star Target Finder score.		MEC
			Final Design	Option 1: Space summary listing, for each building use, the conditioned area, unconditioned area and total area and include total area for each category		MEC
			Final Design	Option 1: List of all simulation output advisory message data and show difference between baseline and proposed design		MEC
			Final Design	Option 1: Comparison summary for energy model inputs including description of baseline and design case energy model inputs, showing both by element type		MEC
			Final Design	Option 1: Energy type summary listing, for each energy type, utility rate description, units of energy and units of demand		MEC
			Final Design	Option 1: Statement indicating whether project uses on-site renewable energy. If yes, list all sources and indicate, for each source, backup energy type, annual energy generated, rated capacity and renewable energy cost		MEC
			Final Design	Option 1: If analysis includes exceptional calculation methods, statement describing how exceptional calculation measure cost savings is determined		MEC
			Final Design	Option 1: If analysis includes exceptional calculation methods, for each exceptional calculation method indicate energy types and, for each energy type, annual energy savings, annual cost savings, and brief descriptive narrative		MEC
			Final Design	Option 1: Baseline performance rating compliance report table indicating, for each energy end use, whether it is a process load, energy type, annual and peak energy demand for all four orientations. For each orientation indicate total annual energy use for each orientation and total annual process energy use.		MEC
			Final Design	Option 1: Baseline energy cost table indicating, for each energy type, annual cost for all four orientations and building total energy cost.		MEC
			Final Design	Option 1: Proposed Design performance rating compliance report table indicating, for each energy end use, whether it is a process load, energy type, annual and peak energy demand, baseline annual and peak energy demand and percent savings. Indicate total annual energy use and total annual process energy use for both proposed design and baseline and percent savings.		MEC
			Final Design	Option 1: Proposed Design energy cost table indicating, for each energy type, annual cost for all four orientations and building total energy cost.		MEC
			Final Design	Option 1: Energy cost and consumption by energy type report indicating, for each energy type, proposed design and baseline annual use and annual cost, percent savings annual use and annual cost. Indicate for renewable energy annual energy generated and annual cost. Indicate exceptional calculations annual energy savings and annual cost savings. Indicate building total annual energy use, annual energy cost for proposed design and baseline and indicate percent savings annual energy use and annual energy cost.		MEC

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			Final Design	Option 1: Compliance summaries from energy simulation software. If software does not produce compliance summaries provide output summaries and example input summaries for baseline and proposed design supporting data in the tables. Output summaries must include simulated energy consumption by end use and total energy use and cost by energy type. Example input summaries should represent most common systems and must include occupancy, use pattern, assumed envelope component sizes and descriptive features and assumed mechanical equipment types and descriptive features		MEC
			Final Design	Option 1: Energy rate tariff from project energy providers (only if not using LEED Reference Guide default rates)		MEC
EA2.1		On-Site Renewable Energy	Final Design	Statement indicating which compliance path option applies.		ELEC
			Final Design	List all on-site renewable energy sources and indicate, for each source, backup energy type, annual energy generated, rated capacity and renewable energy cost. Indicate total annual energy use (all sources), total annual energy cost (all sources) and percent renewable energy cost.		ELEC MEC
			Final Design	Option 1: Indicate, for renewable energy, proposed design total annual energy generated and annual cost.		ELEC MEC
			Final Design	Option 2: Indicate CBECS building type and building gross area. Provide the following CBECS data: median annual electrical intensity, median annual non-electrical fuel intensity, average electric energy cost, average non-electric fuel cost, annual electric energy use and cost, annual non-electric fuel use and cost.		ELEC MEC
			Final Design	Option 2: Narrative describing renewable systems and explaining calculation method used to estimate annual energy generated, including factors influencing performance.		ELEC MEC
EA2.2		On-Site Renewable Energy	Same as EA2.1	Same as EA2.1		ELEC MEC
EA2.3		On-Site Renewable Energy	Same as EA2.1	Same as EA2.1		ELEC MEC
EA3		Enhanced Commissioning	**Final Design	**Owner's Project Requirements document (OPR)		ALL
			**Final Design	**Basis of Design document for commissioned systems (BOD)		ELEC MEC
			**Final Design	**Commissioning Plan		ELEC MEC
			Closeout	Statement confirming all commissioning requirements have been incorporated into construction documents.		PE
			Closeout	**Commissioning Report		PE
			**Final Design	Statement by CxA confirming Commissioning Design Review		
			Closeout	Statement by CxA confirming review of Contractor submittals for compliance with OPR and BOD		PE
			Closeout	**Systems Manual		PE
			Closeout	Statement by CxA confirming completion of O&M staff and occupant training		PE
			Closeout	**Scope of work for post-occupancy review of building operation, including plan for resolution of outstanding issues		PE
			**Predesign	Statement confirming CxA qualifications and contractual relationships relative to work on this project, demonstrating that CxA is an independent third party.		MEC
EA4		Enhanced Refrigerant Management	Final Design	Refrigerant impact calculation table with all building data and calculation values as shown in LEED 2009 Reference Guide Example Calculations		MEC
			Final Design	Narrative describing any special circumstances or explanatory remarks		
			Closeout	X Cut sheets highlighting refrigerant data for all HVAC components.		PE
EA5		Measurement & Verification	Closeout	Statement indicating which compliance path option applies.		PE
			Closeout	Measurement and Verification Plan including Corrective Action Plan		PE
			Closeout	**Scope of work for post-occupancy implementation of M&V plan including corrective action plan.		PE
EA6		Green Power	Closeout	Statement indicating which compliance path option applies.		PE
			Closeout	Option 1: Indicate proposed design total annual electric energy usage		PE
			Closeout	Option 2: Indicate actual total annual electric energy usage		PE
			Closeout	Option 3: Calculation indicating building type, total gross area, median electrical intensity and annual electric energy use		PE

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			Closeout	Green power provider summary table indicating, for each purchase type, provider name, annual quantity green power purchased and contract term. Indicate total annual green power use and indicate percent green power		PE
			Closeout	Narrative describing how Green Power or Green Tags are purchased		PE
<b>CATEGORY 4 – MATERIALS AND RESOURCES</b>						
MRPR1		Storage & Collection of Recyclables (PREREQUISITE)	Final Design	Statement confirming that recycling area will accommodate recycling of plastic, metal, paper, cardboard and glass. Narrative indicating any other materials addressed and coordination with pickup.		ARC
MR1.1		Building Reuse: Maintain 55% of Existing Walls, Floors & Roof	**Final Design	If project includes a building addition, confirm that area of building addition does not exceed 2x the area of the existing building.		ARC
			**Final Design	Spreadsheet listing, for each building structural/envelope element, the existing area and reused area. Total percent reused.		ARC
MR1.2		Building Reuse: Maintain 75% of Existing Walls, Floors & Roof	Same as MR1.1	Same as MR1.1		ARC
MR1.3		Building Reuse: Maintain 95% of Existing Walls, Floors & Roof	Same as MR1.1	Same as MR1.1		ARC
MR1.4		Building Reuse: Maintain 50% of Interior Non-Structural Elements	**Final Design	If project includes a building addition, confirm that area of building addition does not exceed 2x the area of the existing building.		ARC
			**Final Design	Spreadsheet listing, for each building interior non-structural element, the existing area and reused area. Total percent reused.		ARC
MR2.1		Construction Waste Management: Divert 50% From Disposal	**Preconstruction	Waste Management Plan		PE
			**Construction Quarterly and Closeout	Spreadsheet calculations indicating material description, disposal/diversion location (or recycling hauler), weight, total waste generated, total waste diverted, diversion percentage		PE
			**Construction Quarterly and Closeout	Receipts/tickets for all items on spreadsheet		PE
MR2.2		Construction Waste Management: Divert 75% From Disposal	Same as MR2.1	Same as MR2.1		PE
MR3.1		Materials Reuse: 5%	Closeout	Statement indicating total materials value and whether default or actual.		PE
			Closeout	Spreadsheet calculations indicating, for each reused/salvaged material, material description, source or vendor, cost. Total reused/salvaged materials percentage.		PE
MR3.2		Materials Reuse: 10%	Same as MR3.1	Same as MR3.1		PE
MR4.1		Recycled Content: 10% (post-consumer + 1/2 pre-consumer)	Closeout	Statement indicating total materials value and whether default or actual.		PE
			Closeout	Spreadsheet calculations indicating, for each recycled content material, material name/description, manufacturer, cost, post-consumer recycled content percent, pre-consumer recycled content percent, source of recycled content data. Total post-consumer content materials cost, total pre-consumer content materials cost, total combined recycled content materials cost, recycled content materials percentage.		PE
			Final Design or NLT Preconstruction	**Purchasing Plan consisting of spreadsheet indicated above, filled in with estimated quantities to show strategy for achieving goal.		PE
			Closeout	Manufacturer published product data or certification, confirming recycled content percentages in spreadsheet		PE
MR4.2		Recycled Content: 20% (post-consumer + 1/2 pre-consumer)	Same as MR4.1	Same as MR4.1		PE
MR5.1		Regional Materials: 10% Extracted, Processed & Manufactured Regionally	Closeout	Statement indicating total materials value and whether default or actual.		PE
			Closeout	Spreadsheet calculations indicating, for each regional material, material name/description, manufacturer, cost, percent compliant, harvest distance, manufacture distance, source of manufacture and harvest location data. Total regional materials cost, regional materials percentage.		PE
			Preconstruction	**Purchasing Plan consisting of spreadsheet indicated above, filled in with estimated quantities to show strategy for achieving goal.		PE
			Closeout	Manufacturer published product data or certification confirming regional material percentages in spreadsheet		PE

LEED Credit Paragraph	Contractor Check Here if Credit is Claimed	LEED-NC v3 Submittals (OCT09)	Provide for Credit Audit Only	REQUIRED DOCUMENTATION	DATE	REV
PAR		FEATURE	DUE AT			
MR5.2		Regional Materials:20% Extracted, Processed & Manufactured Regionally	Same as MR5.1	Same as MR5.1		PE
MR6		Rapidly Renewable Materials	Closeout	Statement indicating total materials value and whether default or actual.		PE
			Closeout	Spreadsheet calculations indicating, for each rapidly renewable material, material name/description, manufacturer, cost, rapidly renewable content percent, rapidly renewable product value. Total rapidly renewable product value, rapidly renewable materials percentage.		PE
			Final Design	**Purchasing Plan consisting of spreadsheet indicated above, filled in with estimated quantities to show strategy for achieving goal.		ARC
			Closeout	X Manufacturer published product data or certification confirming rapidly renewable material percentages in spreadsheet		PE
MR7		Certified Wood	Closeout	Statement indicating total materials value and whether default or actual.		PE
			Closeout	Spreadsheet calculations indicating, for each certified wood material, material name/description, vendor, cost, wood component percent, certified wood percent of wood component, FSC chain of custody certificate number. Total certified wood product value, certified wood materials percentage.		PE
			Final Design or NLT Preconstruction	**Purchasing Plan consisting of spreadsheet indicated above, filled in with estimated quantities to show strategy for achieving goal.		PE
			Closeout	X Vendor invoices, FSC chain of custody certificates and manufacturer published product data or certification confirming all certified wood materials percentages in spreadsheet.		PE
<b>INDOOR ENVIRONMENTAL QUALITY</b>						
EQPR1		Minimum IAQ Performance (PREREQUISITE)	Final Design	Statement indicating which option for compliance applies, stating applicable criteria/requirement, and confirming that project has been designed to meet the applicable requirements.		MEC
			Final Design	Narrative describing the project's ventilation design, including specifics about fresh air intake volumes and special considerations.		MEC
EQPR2		Environmental Tobacco Smoke (ETS) Control (PREREQUISITE)	Final Design	Statement indicating which option for compliance applies, stating applicable criteria/requirement, and confirming that project has been designed to meet the applicable requirements.		ARC
			Final Design	List of drawing and specification references that convey conformance to applicable requirements (signage, exhaust system, room separation details, etc).		ARC
EQ1		Outdoor Air Delivery Monitoring	Final Design	Statement indicating which option for compliance applies and confirming that project has been designed to meet the applicable requirements.		MEC
			Final Design	List of drawing and specification references that convey conformance to applicable requirements.		MEC
			Final Design	Narrative describing the project's ventilation design and CO2 monitoring system, including specifics about monitors, operational parameters and setpoints.		MEC
			Closeout	X Cut sheets for CO2 monitoring system.		PE
EQ2		Increased Ventilation	Final Design	Statement indicating which option for compliance applies and confirming that project has been designed to meet the applicable requirements.		MEC
			Final Design	Narrative describing the project's ventilation design, including specifics about zone fresh air intake volumes and demonstrating compliance.		MEC
			Final Design	Option 2: Narrative describing design method used for determining natural ventilation design, including calculation methodology/model results and demonstrating compliance.		MEC
			Final Design	List of drawing and specification references that convey conformance to applicable requirements.		MEC
EQ3.1		Construction IAQ Management Plan: During Construction	**Preconstruction	Construction IAQ Management Plan		PE
			Closeout	Statement confirming whether air handling units were operated during construction		PE
			Closeout	Dated jobsite photos showing examples of IAQ management plan practices being implemented. Label photos to indicate which practice they demonstrate. Minimum one photo of each practice at each building.		PE

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PAR		FEATURE	DUE AT			
			Closeout	Spreadsheet indicating, for each filter installed during construction, the manufacturer, model number, MERV rating, location installed, and if it was replaced immediately prior to occupancy.		PE
EQ3.2		Construction IAQ Management Plan: Before Occupancy	**Preconstruction	Construction IAQ Management Plan		PE
			Closeout	Statement indicating which option for compliance applies and confirming that required activities have occurred that meet the applicable requirements.		PE
			Closeout	Option 1a: Narrative describing the project's flushout process, including specifics about temperature, airflow and duration, special considerations (if any) and demonstrating compliance.		PE
			Closeout	Option 1b: Narrative describing the project's pre-occupancy and post-occupancy flushout processes, including specifics about temperature, airflow and duration, special considerations (if any) and demonstrating compliance.		PE
			Closeout	Option 2: Narrative describing the project's IAQ testing process, including specifics about contaminants tested for, locations, remaining work at time of test, retest parameters and special considerations (if any).		PE
			Closeout	Option 2: IAQ testing report demonstrating compliance.		PE
EQ4.1		Low Emitting Materials: Adhesives & Sealants	Closeout	Spreadsheet indicating, for each applicable indoor adhesive, sealant and sealant primer used, the manufacturer, product name/model number, VOC content, LEED VOC limit, and source of VOC data.		PE
			Closeout	Spreadsheet indicating, for each applicable indoor aerosol adhesive, the manufacturer, product name/model number, VOC content, LEED VOC limit, and source of VOC data - OR - Statement confirming no indoor aerosol adhesives were used for the project.		PE
			Closeout	Manufacturer published product data or certification confirming material VOCs in spreadsheet		PE
EQ4.2		Low Emitting Materials: Paints & Coatings	Closeout	Spreadsheet indicating, for each applicable indoor paint and coating used, the manufacturer, product name/model number, VOC content, LEED VOC limit, and source of VOC data.		PE
			Closeout	Spreadsheet indicating, for each applicable indoor anti-corrosive/anti-rust paint and coating used, the manufacturer, product name/model number, VOC content, LEED VOC limit, and source of VOC data - OR - Statement confirming no indoor anti-corrosive/anti-rust paints were used for the project.		PE
			Closeout	Manufacturer published product data or certification confirming material VOCs in spreadsheet		PE
EQ4.3		Low Emitting Materials: Flooring Systems	Closeout	Spreadsheet indicating, for each indoor flooring system used, the manufacturer, product name/model number, if it meets LEED requirement (yes/no) and source of LEED compliance data.		PE
			Closeout	Spreadsheet indicating, for each indoor carpet cushion used, the manufacturer, product name/model number, if it meets LEED requirement (yes/no) and source of LEED compliance data - OR - Statement confirming no indoor carpet cushion was used for the project.		PE
			Closeout	Manufacturer published product data or certification confirming material compliance label in spreadsheet		PE
EQ4.4		Low Emitting Materials: Composite Wood & Agrifiber Products	Closeout	Spreadsheet indicating, for each indoor composite wood and agrifiber product used, the manufacturer, product name/model number, if it contains added urea formaldehyde (yes/no) and source of LEED compliance data.		PE
			Closeout	Manufacturer published product data or certification confirming material urea formaldehyde in spreadsheet		PE
EQ5		Indoor Chemical & Pollutant Source Control	Closeout	Spreadsheet indicating, for each permanent entryway system used, the manufacturer, product name/model number and description of system.		PE
			Final Design	List of drawing and specification references that convey locations and installation methods for entryway systems.		ARC
			Final Design	Spreadsheet indicating, for each chemical use area, the room number, room name, description of room separation features (walls, floor/ceilings, openings) and pressure differential from surrounding spaces with doors closed - OR - Statement confirming that project includes no chemical use areas and that no hazardous cleaning materials are needed for building maintenance.		ARC MEC
			Final Design	If project includes chemical use areas: List of drawing and specification references that convey locations of chemical use areas, room separation features and exhaust system.		ARC MEC

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PAR		FEATURE	DUE AT	REQUIRED DOCUMENTATION	DATE	REV
			Final Design	If project includes places where water and chemical concentrate mixing occurs: List of drawing and specification references that convey provisions for containment of hazardous liquid wastes OR - Statement confirming that project includes no places where water and chemical concentrate mixing occurs.		ARC MEC
			Closeout	If project includes chemical use areas: Spreadsheet indicating, for AHUs/mechanical ventilation equipment serving occupied areas, the manufacturer, model number, MERV rating, location installed, and if it was replaced immediately prior to occupancy (yes/no) - OR - Statement confirming that project does not use mechanical equipment for ventilation of occupied areas.		PE
EQ6.1		Controllability of Systems: Lighting	Final Design	Calculation indicating total number of individual workstations, number of workstations with individual lighting controls and the percentage of workstations with individual lighting controls.		ELEC
			Final Design	For each shared multi-occupant space, provide a brief description of lighting controls.		ELEC
			Final Design	Narrative describing lighting control strategy, including type and location of individual controls and type and location of controls in shared multi-occupant spaces.		ELEC
EQ6.2		Controllability of Systems: Thermal Comfort	Final Design	Calculation indicating total number of individual workstations, number of workstations with individual thermal comfort controls and the percentage of workstations with individual thermal comfort controls.		MEC
			Final Design	For each shared multi-occupant space, provide a brief description of thermal comfort controls.		MEC
			Final Design	Narrative describing thermal comfort control strategy, including type and location of individual and shared multi-occupant controls.		MEC
EQ7.1		Thermal Comfort: Design	Final Design	Design criteria spreadsheet indicating, for spring, summer, fall and winter, maximum indoor space design temperature, minimum indoor space design temperature and maximum indoor space design humidity.		MEC
			Final Design	Narrative describing method used to establish thermal comfort control conditions and how systems design addresses the design criteria, including compliance with the referenced standard.		MEC
EQ7.2		Thermal Comfort: Verification	Final Design	Narrative describing the scope of work for the thermal comfort survey, including corrective action plan development		MEC
			Final Design	List of drawing and specification references that convey permanent monitoring system.		MEC
EQ8.1		Daylight & Views: Daylight 75% of Spaces	Final Design	Option 2: Table indicating all regularly occupied spaces with space area and space area with compliant daylight zone. Sum of regularly occupied areas and regularly occupied areas with compliant daylight zone. Percentage calculation of areas with compliant daylight zone to total regularly occupied areas.		ARC
			Final Design	Option 1: Simulation model method, software and output data		ELEC
			Final Design	Option 1: Table indicating all regularly occupied spaces with space area, space area with minimum 25 footcandles daylighting illumination, and method of providing glare control. Sum of regularly occupied areas and regularly occupied areas with 25 fc daylighting. Percentage calculation of areas with 25 fc daylighting to total regularly occupied areas.		ELEC
			Final Design	For all occupied spaces excluded from the calculation, provide narrative indicating reasons for excluding the space.		ARC
			Final Design	List of drawing and specification references that convey exterior glazed opening head and sill heights, glazing performance properties and glare control/sunlight redirection devices.		ARC
			Closeout	Manufacturer published product data or certification confirming glazing Tvis in spreadsheet		PE
EQ8.2		Daylight & Views: Views for 90% of Spaces	Final Design	Table indicating all regularly occupied spaces with space area and space area with access to views. Sum of regularly occupied areas and regularly occupied areas with access to views. Percentage calculation of areas with views to total regularly occupied areas.		ARC
			Final Design	For all occupied spaces excluded from the calculation, provide narrative indicating reasons for excluding the space.		ARC
			Final Design	LEED Floor plan drawings showing line of sight diagramming of views areas in each regularly occupied space. List of drawing/specification references that convey exterior glazed opening head and sill heights.		ARC
INNOVATION & DESIGN PROCESS						

LEED Credit Paragraph	Contractor Check Here if Credit is Claimed			Provide for Credit Audit Only		Date Submitted (to be filled in by Contractor)	Government Reviewer's Use
		<b>LEED-NC v3 Submittals (OCT09)</b>					
PAR		FEATURE	DUE AT		REQUIRED DOCUMENTATION	DATE	REV
IDc1.1		Innovation in Design	Final Design		Narrative describing intent, requirement for credit, project approach to the credit. List of drawings and specification references that convey implementation of credit. All other documentation that validates claimed credit.		
IDc1.2		Innovation in Design	Final Design				
IDc1.3		Innovation in Design	Final Design				
IDc1.4		Innovation in Design	Final Design				
IDc2		LEED Accredited Professional	Final Design		Narrative indicating name of LEED AP, company name of LEED AP, description of LEED AP's role and responsibilities in the project.		ARC

**ATTACHMENT F**  
Version 05-31-2011

**BUILDING INFORMATION MODELING REQUIREMENTS**

**1.0 Section 1 - General**

- 1.1. Definitions. See Section 7 for definitions of terms used in this document.
- 1.2. Submittal Format
  - 1.2.1. The Model shall be developed using Building Information Modeling ("BIM") supplemented with Computer Aided Design ("CAD") content as necessary to produce a complete set of Construction Documents. Printed design submittal drawings shall be ANSI D size, suitable for half-size scaled reproduction.
  - 1.2.2. BIM submittals shall conform to the requirements of Sections 3 and 4 below.
  - 1.2.3. For each Center of Standardization (CoS) facility type included in this Project, all Models and associated Facility Data shall be submitted in Bentley BIM [Not Supplied - SubmittalReqCADDSystem : BENTLEY\_VERSION]. The submittals shall be fully operable, compatible, and editable within the native BIM tools.

**2.0 Section 2 – Design Requirements**

- 2.1. Use of BIM for Design. Contractor shall use BIM application(s) and software(s) to develop Project designs consistent with the following requirements.
  - 2.1.1. Baseline Model. The Contractor will be provided a baseline multi-discipline BIM Project Model.
  - 2.1.2. USACE BIM Workspace. The USACE Bentley BIM Workspace [Not Supplied - SubmittalReqCADDSystem : USACE\_WORKSPACE\_VERSION] must be used and can be downloaded from the CAD/BIM Technology Center website, currently <https://cadbim.usace.army.mil>.
  - 2.1.3. Reference. Refer to ERDC TR-06-10, "U.S. Army Corps of Engineers Building Information Modeling Road Map" from the CAD/BIM Technology Center website for more information on the USACE BIM implementation goals.
  - 2.1.4. Industry Foundation Class (IFC) Support. The Contractor's selected BIM application(s) and software(s) must be consistent with the current IFC property sets. Any deviations from or additions to the IFC property sets for any new spaces, systems, and equipment must be submitted for Government acceptance.
  - 2.1.5. BIM Project Execution Plan.
    - 2.1.5.1. Develop a BIM Project Execution Plan ("Plan" or "PxP") documenting the BIM uses, analysis technologies and workflows.
    - 2.1.5.2. Contractors shall utilize the link for the USACE BIM PROJECT EXECUTION PLAN (USACE PxP) Template located in Attachment H to develop an acceptable Plan.
- 2.2. BIM Requirements.



2.2.1. Facility Data. Develop the Facility Data to include material definitions and attributes that are necessary for the Project facility design and construction as described in Section 4.0. Additional data in support of Section 6.0 Contractor Electives is encouraged to be added to the Model.

2.2.2. Model Content. The Model and Facility Data shall include, at a minimum, the requirements of Section 4 below.

2.2.3. Model Granularity. Individual elements may vary in level of detail within the Model, but at a minimum must include all features that would be included on a quarter inch ( $1/4" = 1'0"$ ) scaled drawing (e.g., at least  $1/16^{th}$ ,  $1/8^{th}$  and  $1/4^{th}$ ), or on appropriately scaled civil drawings.

2.3. Output. Submitted Drawings (e.g., plans, elevations, sections, schedules, details, etc.) shall be derived (commonly known as extractions, views or sheets) from the Model and Facility Data. Drawings derived from the Model shall remain connected to the Model for the life of the Project and documented in the PxP. Drawings not derived from the Model shall also be documented in the PxP.

2.3.1. Drawings derived from the Model shall be compliant with the A/E/C CAD Standard. Deliver electronic CAD files used for the creation of the Construction Documents per requirements in Section 01 33 16, the criteria of the USACE Baltimore District, and as noted herein.

2.3.2. The CAD file format specified for drawings shall not dictate which application(s) are used for development and execution of the Model and Facility Data. Application(s) used shall be documented in the PxP.

2.4. Quality Control Parameters. Implement quality control ("QC") parameters for the Model, including:

2.4.1. Model Standards Checks. QC validation ensures that the Project Facility Data set has no undefined, incorrectly defined or duplicated elements. Identify and report non-compliant elements and submit a corrective action plan. Provide the Government with detailed justification and request Government acceptance for any non-compliant element that the Contractor proposes to be allowed to remain in the Model.

2.4.2. CAD Standards Checks. QC checking ensures that the fonts, dimensions, line styles, levels and other construction document formatting issues are followed per requirements in Section 01 33 16. Identify and report non-compliant content and submit a corrective action plan.

2.4.3. Other Parameters. Develop such other QC parameters as Contractor deems appropriate for the Project and provide to the Government for acceptance.

2.5. Design and Construction Reviews. Perform design and construction reviews at each submittal stage under Section 3 to test the Model, including:

2.5.1. Visual Checks. Checking to ensure the design intent has been followed and that there are no unintended elements in the Model.

2.5.2. Interference Management Checks. Locate conflicting spatial data in the Model where two elements are occupying the same space. Log hard interferences (e.g., mechanical vs. structural, or mechanical vs. mechanical, overlaps in the same location) and soft interferences, (e.g., conflicts regarding equipment clearance, service access, fireproofing, insulation, code space requirements) in a written report and resolve.

2.5.3. IFC Coordination View. Provide an IFC Coordination View in IFC Express format for all deliverables. Provide exported property set data for all IFC supported named building elements.

2.5.4. Other Parameters. Develop other design and construction review parameters as the Contractor deems appropriate for the Project and provide to the Government for acceptance.

### **3.0 Section 3 – Submittal Requirements**

#### **3.1. General Submittal Requirements.**

3.1.1. Provide submittals in compliance with the PxP deliverables at stages as described below.

3.1.2. For each Interim Design Submittal as set forth in Paragraphs 3.3 through 3.6, provide a Contractor-certified written report confirming that consistency checks as identified in Paragraphs 2.4 and 2.5 above have been completed. This report shall be discussed as part of the review process and shall address cross-discipline interferences, if any.

3.1.3. At each Interim Design Submittal as set forth in Paragraphs 3.3 through 3.6, provide the Government with:

3.1.3.1. The Model, Facility Data, Workspace and CAD Data files in the native BIM/CAD format.

3.1.3.2. A copy of the Model in an interactive review format such as Bentley Navigator, Autodesk Navisworks, Adobe 3D PDF 7.0 (or later), Google Earth KMZ or other format per PxP requirements. The format for reviews can change between submittals.

3.1.3.3. A list of all submitted electronic files including a description, directory, and file name for each file submitted. For all CAD printed sheets, include a list of the sheet titles and sheet numbers. Identify which files have been produced from the Model and Facility Data.

3.1.4. The Government shall confirm acceptability of all submittals identified in Section 3 in coordination with the USACE Geographic District BIM Manager.

#### **3.2. Initial Design Conference Submittal.**

3.2.1. Submit a digital copy of the PxP where, in addition to Paragraph 3.1.4, the USACE Geographic District BIM Manager will coordinate with the USACE CoS BIM Manager to confirm acceptability of the Plan or advise as to additional processes or activities necessary to be incorporated into the PxP.

3.2.2. Within thirty (30) days after the acceptance of the PxP, conduct a demonstration to review the Plan for clarification, and to verify the functionality of planned Model technology workflow and processes. If modifications are required, the Contractor shall complete the modifications and resubmit the PxP performing a subsequent demonstration for Government acceptance. There will be no payment for design or construction until the PxP is completed and accepted by the Government. The Government may also withhold payment if there is design and construction for unacceptable performance in executing the accepted PxP.

#### **3.3. Interim Design Submittals.**

3.3.1. BIM and CAD Data. Submit the Model with Facility Data per the requirements identified in Paragraphs 2.2 and 2.3 as applicable to the Interim Design package(s).

#### **3.4. Final Design Submissions and Design Complete Submittals.**

3.4.1. BIM and CAD Data. Submit the Model with Facility Data per the requirements identified in Paragraphs 2.2 and 2.3. Acceptance according to Paragraph 3.1.4 is required before commencement of construction, as described in Paragraph 3.7.6 of Section 01 33 16.

3.5. Construction Submittals – Over-The-Shoulder Progress Reviews. Periodic quality control meetings or construction progress review meetings shall include quality control reviews on the implementation and use of the Model, including interference management and design change tracking information.

3.6. Final As-Built BIM and CAD Data Submittal. Submit the final Model, Facility Data, and CAD files reflecting as-built construction conditions for Government acceptance, as specified in Section 01 78 02.00 10, PROJECT CLOSEOUT.

#### **4.0 Section 4 – BIM Model Minimum Requirements and Output**

4.1. General Provisions. The Model shall be developed to include the systems described below as they would be built, the processes of installing them, and to reflect final as-built construction conditions. The deliverable Model at the Interim Design Stage and at the Final Design Stage (“released for construction”) shall be developed to include as many of the systems described below as are necessary and appropriate at that design stage.

4.2. Architectural/Interior Design. The Architectural systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4”=1’0”) scaled drawing. Additional minimum Model requirements include:

4.2.1. Spaces. The Model shall include spaces defining actual net square footage and net volume, and holding data to develop the room finish schedule including room names and numbers. Include program information to verify design space against programmed space, using this information to validate area quantities.

4.2.2. Walls and Curtain Walls. Each wall shall be depicted to the exact height, length, width and ratings (thermal, acoustic, fire) to properly reflect wall types. The Model shall include all walls, both interior and exterior, and the necessary intelligence to produce accurate plans, sections and elevations depicting these design elements.

4.2.3. Doors, Windows and Louvers. Doors, windows and louvers shall be depicted to represent their actual size, type and location. Doors and windows shall be modeled with the necessary intelligence to produce accurate window and door schedules.

4.2.4. Roof. The Model shall include the roof configuration, drainage system, penetrations, specialties, and the necessary intelligence to produce accurate plans, building sections and generic wall sections where roof design elements are depicted.

4.2.5. Floors. The floor slab(s) shall be developed in the Structural Model and then referenced by the Architectural Model.

4.2.6. Ceilings. All heights and other dimensions of ceilings, including soffits, ceiling materials, or other special conditions shall be depicted in the Model with the necessary intelligence to produce accurate plans, building sections and wall sections where ceiling design elements are depicted.

4.2.7. Vertical Circulation. All continuous vertical components (i.e., non-structural shafts, architectural stairs, handrails and guardrails) shall be accurately depicted and shall include the necessary intelligence to produce accurate plans, elevations and sections in which such design elements are referenced.

4.2.8. Architectural Specialties. All architectural specialties (i.e., toilet room accessories, toilet partitions, grab bars, lockers, and display cases) and millwork (i.e., cabinetry and counters) shall be accurately depicted with the necessary intelligence to produce accurate plans, elevations, sections and schedules in which such design elements are referenced.

4.2.9. Signage. The Model shall include all signage and the necessary intelligence to produce accurate plans and schedules.

4.2.10. Schedules. Provide door, window, hardware sets using BHMA designations, flooring, wall finish, and signage schedules from the Model, indicating the type, materials and finishes used in the design.

4.3. Furniture. The furniture Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing, and have necessary intelligence to produce accurate plans. Representation of furniture elements is to be 2D. Contractor may provide a minimal number of 3D representations as examples. Examples of furniture include, but are not limited to, desks, furniture systems, seating, tables, and office storage.

4.3.1. Furniture Coordination. Furniture that makes use of electrical, data or other features shall include the necessary intelligence to produce coordinated documents and data.

4.4. Equipment. The Model may vary in level of detail for individual elements. Equipment shall be depicted to meet layout requirements with the necessary intelligence to produce accurate plans and schedules, indicating the configuration, materials, finishes, mechanical, and electrical requirements.. Examples of equipment include but are not limited to copiers, printers, refrigerators, ice machines and microwaves.

4.4.1. Schedules. Provide furniture and equipment schedules from the model indicating the materials, finishes, mechanical, and electrical requirements.

4.5. Structural. The Structural systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing. Additional minimum Model requirements include:

4.5.1. Foundations. All necessary foundation and/or footing elements, with necessary intelligence to produce accurate plans and elevations.

4.5.2. Floor Slabs. Structural floor slabs shall be depicted with all necessary recesses, curbs, pads, closure pours, and major penetrations accurately depicted.

4.5.3. Structural Steel. All steel columns, primary and secondary framing members, and steel bracing for the roof and floor systems (including decks), including all necessary intelligence to produce accurate structural steel framing plans, related building/wall sections, and schedules.

4.5.4. Cast-in-Place Concrete. All walls, columns, beams, including necessary intelligence to produce accurate plans and building/wall sections, depicting cast-in-place concrete elements.

4.5.5. Expansion/Contraction Joints. Joints shall be accurately depicted.

4.5.6. Stairs. All framing members for stair systems, including necessary intelligence to produce accurate plans and building/wall sections depicting stair design elements.

4.5.7. Shafts and Pits. All shafts and pits, including necessary intelligence to produce accurate plans and building/wall sections depicting these design elements.

4.5.8. Openings and Penetrations. All major openings and penetrations that would be included on a quarter inch (1/4"=1'0") scaled drawing.

4.6. Mechanical. The Mechanical systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0")

scaled drawing. Small diameter (less than 1-1/2" NPS) field-routed piping is not required to be depicted in the Model. Additional minimum Model requirements include:

4.6.1. HVAC. All necessary heating, ventilating, air-conditioning and specialty equipment, including air distribution for supply, return, ventilation and exhaust ducts, control systems, registers, diffusers, grills, and hydronic baseboards with necessary intelligence to produce accurate plans, elevations, building/wall sections and schedules.

4.6.1.1. Mechanical Piping. All necessary piping and fixture layouts, and related equipment, including necessary intelligence to produce accurate plans, elevations, building/wall sections, and schedules.

4.6.2. Plumbing. All necessary plumbing piping and fixture layouts, floor and area drains, and related equipment, including necessary intelligence to produce accurate plans, elevations, building/wall sections, riser diagrams, and schedules.

4.6.3. Equipment Clearances. All Mechanical equipment clearances shall be modeled for use in interference management and maintenance access requirements.

4.6.4. Elevator Equipment. All necessary equipment and control systems, including necessary intelligence to produce accurate plans, sections and elevations depicting these design elements.

4.7. Electrical/Telecommunications. The Electrical and Telecommunications systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing. Small diameter (less than 1-1/2"Ø) field-routed conduit is not required to be depicted in the Model. Additional minimum Model requirements include:

4.7.1. Interior Electrical Power and Lighting. All necessary interior electrical components (i.e., lighting, receptacles, special and general purpose power receptacles, lighting fixtures, panelboards, cable trays and control systems), including necessary intelligence to produce accurate plans, details and schedules. Lighting and power built into furniture/equipment shall be modeled.

4.7.2. Special Electrical. All necessary special electrical components (i.e., security, mass notification, public address, nurse call and other special electrical occupancy sensors, and control systems), including necessary intelligence to produce accurate plans, details and schedules.

4.7.3. Grounding. All necessary grounding components (i.e., lightning protection systems, static grounding systems, communications grounding systems, and bonding), including necessary intelligence to produce accurate plans, details and schedules.

4.7.4. Telecommunications. All existing and new telecommunications service controls and connections, both above ground and underground, with necessary intelligence to produce accurate plans, details and schedules. Cable tray routing shall be modeled without detail of cable contents.

4.7.5. Exterior Building Lighting. All necessary exterior lighting including all lighting fixtures, relevant existing and proposed support utility lines and equipment with necessary intelligence to produce accurate plans, details and schedules.

4.7.6. Equipment Clearances. All Electrical equipment clearances shall be modeled for use in interference management and maintenance access requirements.

4.8. Fire Protection. The fire protection system Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing. Additional minimum Model requirements include:

4.8.1. Fire Protection System. All relevant fire protection components (i.e., branch piping, sprinkler heads, fittings, drains, pumps, tanks, sensors, control panels) with necessary intelligence to produce accurate plans, elevations, building/wall sections, riser diagrams, and schedules. All fire protection piping shall be modeled.

4.8.2. Fire Alarms. Fire alarm/mass notification devices and detection system shall be indicated with necessary intelligence to produce accurate plans depicting them.

4.9. Civil. The Civil Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a one inch (1"=100') scaled drawing. Additional minimum Model requirements include:

4.9.1. Terrain (DTM). All relevant site conditions and proposed grading, including necessary intelligence to produce accurate Project site topographical plans and cross sections.

4.9.2. Drainage. All existing and new drainage piping, including upgrades thereto, including necessary intelligence to produce accurate plans and profiles for the Project site.

4.9.3. Storm Water and Sanitary Sewers. All existing and new sewer structures and piping, including upgrades thereto, with necessary connections to mains or other distribution points as appropriate, including necessary intelligence to produce accurate plans and profiles .

4.9.4. Utilities. All necessary new utilities connections from the Project building(s) to the existing or newly-created utilities, and all existing above ground and underground utility conduits, including necessary intelligence to produce accurate plans and site-sections.

4.9.5. Roads and Parking. All necessary roadways, parking lots, and parking structures, including necessary intelligence to produce accurate plans, profiles and cross-sections.

## **5.0 Section 5 - Ownership and Rights in Data**

5.1. Ownership. The Government has ownership of and rights at the date of Closeout Submittal to all CAD files, BIM Model, and Facility Data developed for the Project in accordance with FAR Part 27, clauses incorporated in Section 00 72 00, Contract Clauses and Special Contract Requirement 1.14 GOVERNMENT RE-USE OF DESIGN (Section 00 73 00). The Government may make use of this data following any deliverable.

## **6.0 Section 6 – Contractor Electives**

6.1. Applicable Criteria. If the Contractor elected to include one or more of the following features as an elective in its accepted contract proposal for additional credit, as described in the proposal submission requirements and evaluation criteria, the requirements of paragraphs 6.2 through 6.5 are as applicable for those elective feature(s) that will be included in the project.

6.2. COBIE Compliance. The Model and Facility Data for the Project shall fulfill Construction Operations Building Information Exchange (COBIE) requirements on the Whole Building Design Guide website ([www.wbdg.org](http://www.wbdg.org)) , including all requirements for the indexing and submission of Portable Document Format (PDF) and other appropriate records that would otherwise be printed and submitted in compliance with Project operations and maintenance handover requirements.

6.3. Project Scheduling using the Model. In the PxP and during the Initial Design Conference Submittal Demonstration, provide an overview of the use of BIM in the development and support of the Project construction schedule.

6.3.1. Submittal Requirements. During the Stages identified in Paragraphs 3.3 through 3.6, the Contractor shall deliver the construction schedule derived from the Model.

6.3.1.1. Construction Submittals – Over-The-Shoulder Progress Reviews. Periodic quality control meetings or construction progress review meetings shall include quality control reviews on the implementation and use of the Model for Project scheduling.

6.4. Cost Estimating. In the PxP and during the Initial Design Conference Submittal Demonstration, provide an overview of the use of BIM in the development and support of cost estimating, or other costing applications such as comparative cost analysis for proposed changes and estimate validation.

6.4.1. Submittal Requirements. During the Stages identified in Paragraphs 3.3 through 3.6, the Contractor shall deliver cost estimating information derived from the Model.

6.4.2. Project Completion. At Project completion, the Contractor shall provide an Micro Computer Aided Cost Estimating System Generation II ("MII") Cost Estimate that follows the USACE Cost Engineering Military Work Breakdown System ("WBS"), a modified Uniformat, to at least the sub-systems level and uses quantity information supplied directly from Model output to the maximum extent possible, though other "gap" quantity information will be included by the contractor as necessary for a complete and accurate Cost Estimate. (See Paragraph 6.4.2.2).

6.4.2.1. Sub system level extracted quantities from the Model for use within the Estimate shall be provided according to how detailed line items or tasks should be installed/built so that accurate costs can be developed and/or reflected. When developing a Model, the contractor shall be cognizant of construction sequencing at the beginning stages of Model development, such as recognizing tasks performed on the first floor versus the same task on higher floors that will be more labor intensive and, therefore, need to have a separate quantity and be priced differently. Tasks and their extracted quantities from the Model shall be broken down by their location (proximity in the structure) as well as the complexity of installation.

6.4.2.2. At all design Stages it shall be acknowledged that BIM output will not generate all quantities that are necessary in order to develop a complete and accurate cost estimate of the Project based on the design alone. (An example of this would be plumbing that is less than 1.5" diameter and, therefore, not expected to be modeled due to permitted level of design granularity; this information is commonly referred to as "The Gap". Quantities addressing "The Gap" and their associated costs shall be included in the final Project actual Cost Estimates as well even though not derived directly from the Model data).

6.5. Other Analyses and Reports. Structural, energy and efficiency, EPACT 2005 & EISA 2007, lighting design, daylighting, electrical power, psychrometric processing, shading, programming, LEED, fire protection, code compliance, Life Cycle Cost, acoustic, plumbing and other analyses that may be generated from the Model or reports summarizing the data compiled from these analyses shall be submitted in the form established by contractor in its accepted PxP.

## **7.0 Definitions**

7.1. The following definitions apply specifically in the context of this attachment only.

7.2. "Model": An electronic, three-dimensional representation of facility elements with associated intelligent attribute data ("Facility Data").

7.3. "Facility Data": The non-graphical information attached to objects in the Model that defines various characteristics of the object. Facility Data can include properties such as parametric values that drive physical sizes, material definitions and characteristics (e.g. wood, metal), manufacturer data, industry standards (e.g. AISC steel properties), and project identification numbers. Facility Data can also

define supplementary physical entities that are not shown graphically in the Model, such as insulation around a duct, or hardware on a door.

7.4. “Workspace”: A collection of content libraries and supporting files that define and embody a BIM standard. A workspace includes BIM libraries such as wall types, standard steel shapes, furniture, HVAC fittings, and sprinkler heads. It also contains sheet libraries such as print/plot configurations, font and text style libraries, and sheet borders and title blocks. The USACE has developed Workspaces specific to USACE BIM standards; these workspaces are dependent on specific versions of the BIM applications they serve. All USACE BIM Workspaces can be downloaded from the CAD/BIM Technology Center (<https://cadbim.usace.army.mil>). In some cases, there is a specific Workspace for a given CoS Facility Standard Design.

7.5. “IFC”: Industry Foundation Class, a standard and file format used for the exchange of BIM data; see [www.iai-tech.org](http://www.iai-tech.org). Note: In the context of this attachment, IFC does not mean “Issued For Construction.”







**ATTACHMENT G****DESIGN SUBMITTAL DIRECTORY AND SUBDIRECTORY FILE ARRANGEMENT**

Organize electronic design submittal files in a subdirectory/file structure in accordance with the following table.

The Contractor may suggest a slightly different structure, subject to the discretion of the government.

**Design Submittal Directory and Subdirectory File Arrangement.**

Directory	Sub-Directory	Sub-Directory or Files	Files
Submittal/Package Name	Narratives	PDF file or files with updated design narrative for each applicable design discipline	
	Drawings	PDF (subdirectory)	Single PDF file with all applicable drawing sheets - bookmarked by sheet number and name
		BIM (subdirectory) See Attachment F.	BIM project folder (with files) per the USACE Workspace. Include an Excel drawing index file with each drawing sheet listed by sheet #, name and corresponding dgn file name (Final Design & Design Complete only)
	Design Analysis & Calculations	Individual PDF files containing design analysis and calculations for each discipline applicable to the submittal	
		PDF file with Fire Protection and Life Safety Code Review checklist	
	LEED	PDF file with updated Leed Check List	
		PDF file or files with LEED Templates for each point with applicable documentation included in each file.	
		LEED SUBMITTALS	
	Energy Analysis	PDF with baseline energy consumption analysis	
		PDF with actual building energy consumption analysis	
	Specifications	Single PDF file with table of contents and all applicable specifications sections.	
		Submittal Register (Final Design & Design Complete submittal only)	
	Design Quality Control	PDF file or files with DQC checklist(s) and/or statements	
	Building Rendering(s)	PDF file of rendering for each building type included in contract (Final Design & Design Complete).	

**ATTACHMENT H**  
**USACE BIM Project Execution Plan (PxP) Template Version 1.0**

This template is a tool that is provided to assist in the development of a USACE BIM Project Execution Plan as required per contract. The template provides a standard format for organizations to establish their general means and methods for meeting the scope and deliverable requirements in Attachment F. It was adapted from the buildingSMART alliance™ (bSa) Project "BIM Project Execution Planning" as developed by The Computer Integrated Construction (CIC) Research Group of The Pennsylvania State University. The bSa project is sponsored by The Charles Pankow Foundation, Construction Industry Institute (CII), Penn State Office of Physical Plant (OPP), and The Partnership for Achieving Construction Excellence (PACE). The template can be found at the following link:

[https://mrsi.usace.army.mil/rfp/Shared%20Documents/USACE\\_BIM\\_PXP\\_TEMPLATE\\_V1.0.pdf](https://mrsi.usace.army.mil/rfp/Shared%20Documents/USACE_BIM_PXP_TEMPLATE_V1.0.pdf)

Please note: Instructions and examples to assist with the completion of this template are currently in grey. The text can and should be modified to suit the needs of the organization filling out the template. If modified, the format of the text should be changed to match the rest of the document. This can be completed, in most cases, by selecting the normal style in the template styles.

**SECTION 01 45 01.10**  
**QUALITY CONTROL SYSTEM (QCS)**

**1.0 GENERAL**

- 1.1. CORRESPONDENCE AND ELECTRONIC COMMUNICATIONS
- 1.2. QCS SOFTWARE
- 1.3. SYSTEM REQUIREMENTS
- 1.4. RELATED INFORMATION
- 1.5. CONTRACT DATABASE
- 1.6. DATABASE MAINTENANCE
- 1.7. IMPLEMENTATION
- 1.8. DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM
- 1.9. MONTHLY COORDINATION MEETING
- 1.10. NOTIFICATION OF NONCOMPLIANCE

## 1.0 GENERAL

The Government will use the Resident Management System for Windows (RMS) to assist in its monitoring and administration of this contract. The Contractor shall use the Government-furnished Construction Contractor Module of RMS, referred to as QCS, to record, maintain, and submit various information throughout the contract period. The Contractor module, user manuals, updates, and training information can be downloaded from the RMS web site. This joint Government-Contractor use of RMS and QCS will facilitate electronic exchange of information and overall management of the contract. QCS provides the means for the Contractor to input, track, and electronically share information with the Government in the following areas:

- Administration
- Finances
- Quality Control
- Submittal Monitoring
- Scheduling
- Import/Export of Data
- Request for Information
- Accident Reporting
- Safety Exposure Manhours

### 1.1. CORRESPONDENCE AND ELECTRONIC COMMUNICATIONS

For ease and speed of communications, both Government and Contractor will exchange correspondence and other documents in electronic format. Correspondence, pay requests and other documents comprising the official contract record shall also be provided in paper format, with signatures and dates where necessary. Paper documents will govern, in the event of discrepancy with the electronic version.

### 1.2. OTHER FACTORS

Particular attention is directed to Contract Clause, "Schedules for Construction Contracts", Contract Clause, "Payments", Section 01 32 01.00 10, PROJECT SCHEDULE, Section 01 33 00, SUBMITTAL PROCEDURES, and Section 01 45 04.00 10, CONTRACTOR QUALITY CONTROL, which have a direct relationship to the reporting to be accomplished through QCS. Also, there is no separate payment for establishing and maintaining the QCS database; all costs associated therewith shall be included in the contract pricing for the work.

### 1.3. QCS SOFTWARE

QCS is a Windows-based program that can be run on a stand-alone personal computer or on a network. The Government will make available the QCS software to the Contractor after award of the construction contract. Prior to the Pre-Construction Conference, the Contractor shall be responsible to download, install and use the latest version of the QCS software from the Government's RMS Internet Website. Upon specific justification and request by the Contractor, the Government can provide QCS on CD-ROM. Any program updates of QCS will be made available to the Contractor via the Government RMS Website as they become available.

### 1.4. SYSTEM REQUIREMENTS

The following listed hardware and software is the minimum system configuration that the Contractor shall have to run QCS:

- (a) Hardware
  - IBM-compatible PC with 1000 MHz Pentium or higher processor
  - 256 MB RAM for workstation / 512+ MB RAM for server

- 1 GB hard drive disk space for sole use by the QCS system
- Compact disk (CD) Reader, 8x speed or higher
- SVGA or higher resolution monitor (1024 x 768, 256 colors)
- Mouse or other pointing device
- Windows compatible printer (Laser printer must have 4+ MB of RAM)
- Connection to the Internet, minimum 56K BPS

(b) Software

- MS Windows 2000 or higher
- MS Word 2000 or newer
- Latest version of : Netscape Navigator, Microsoft Internet Explorer, or other browser that supports HTML 4.0 or higher
- Electronic mail (E-mail), MAPI compatible
- Virus protection software that is regularly upgraded with all issued manufacturer's updates

1.5. RELATED INFORMATION

1.5.1. QCS USER GUIDE

After contract award, the Contractor shall download instructions for the installation and use of QCS from the Government RMS Internet Website. In case of justifiable difficulties, the Government will provide the Contractor with a CD-ROM containing these instructions.

1.5.2. CONTRACTOR QUALITY CONTROL (CQC) TRAINING

The use of QCS will be discussed with the Contractor's QC System Manager during the mandatory CQC Training class.

1.6. CONTRACT DATABASE

Prior to the pre-construction conference, the Government will provide the Contractor with basic contract award data to use for QCS. The Government will provide data updates to the Contractor as needed, generally by using the government's SFTP repository built into QCS import/export function. These updates will generally consist of submittal reviews, correspondence status, QA comments, and other administrative and QA data.

1.7. DATABASE MAINTENANCE

The Contractor shall establish, maintain, and update data for the contract in the QCS database throughout the duration of the contract. The Contractor shall establish and maintain the QCS database at the Contractor's site office. Data updates to the Government, e.g., daily reports, submittals, RFI's, schedule updates, payment requests, etc. shall be submitted using the government's SFTP repository built into QCS export function. If permitted by the Contracting Officer, email or CD-ROM may be used instead (see Paragraph DATA SUBMISSION VIA CD-ROM). The QCS database typically shall include current data on the following items:

1.7.1. ADMINISTRATION

1.7.1.1. Contractor Information

The database shall contain the Contractor's name, address, telephone numbers, management staff, and other required items. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver Contractor administrative data in electronic format.

1.7.1.2. Subcontractor Information

The database shall contain the name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor must be listed separately for each trade to be performed. Each subcontractor/trade shall be assigned a unique Responsibility Code, provided in QCS. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver subcontractor administrative data in electronic format.

#### 1.7.1.3. Correspondence

All Contractor correspondence to the Government shall be identified with a serial number. Correspondence initiated by the Contractor's site office shall be prefixed with "S". Letters initiated by the Contractor's home (main) office shall be prefixed with "H". Letters shall be numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to the Contractor will be prefixed with "C".

All Requests For Information (RFI) shall be exchanged using the Built-in RFI generator and tracker in QCS.

#### 1.7.1.4. Equipment

The Contractor's QCS database shall contain a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates.

#### 1.7.1.5. Management Reporting

QCS includes a number of reports that Contractor management can use to track the status of the project. The value of these reports is reflective of the quality of the data input, and is maintained in the various sections of QCS. Among these reports are: Progress Payment Request worksheet, QA/QC comments, Submittal Register Status, Three-Phase Inspection checklists.

### 1.7.2. FINANCES

#### 1.7.2.1. Pay Activity Data

The QCS database shall include a list of pay activities that the Contractor shall develop in conjunction with the design and construction schedule. The sum of all pay activities shall be equal to the total contract amount, including modifications. Pay activities shall be grouped by Contract Line Item Number (CLIN), and the sum of the activities shall equal the amount of each CLIN. The total of all CLINs equals the Contract Amount.

#### 1.7.2.2. Payment Requests

All progress payment requests shall be prepared using QCS. The Contractor shall complete the payment request worksheet prompt payment certification, and payment invoice in QCS. The work completed under the contract, measured as percent or as specific quantities, shall be updated at least monthly. After the update, the Contractor shall generate a payment request report using QCS. The Contractor shall submit the payment request, prompt payment certification, and payment invoice with supporting data by using the government's SFTP repository built into QCS export function. If permitted by the Contracting Officer, E-mail or a CD-ROM may be used. A signed paper copy of the approved payment request is also required, which shall govern in the event of discrepancy with the electronic version.

### 1.7.3. Quality Control (QC)

QCS provides a means to track implementation of the 3-phase QC Control System, prepare daily reports, identify and track deficiencies, document progress of work, and support other contractor QC requirements. The Contractor shall maintain this data on a daily basis. Entered data will automatically output to the QCS generated daily report. The Contractor shall provide the Government a Contractor



Quality Control (CQC) Plan within the time required in Section 01 45 04.00 10, CONTRACTOR QUALITY CONTROL. Within seven calendar days of Government acceptance, the Contractor shall submit a QCS update reflecting the information contained in the accepted CQC Plan: schedule, pay activities, features of work, submittal register, QC requirements, and equipment list.

#### 1.7.3.1. Daily Contractor Quality Control (CQC) Reports

QCS includes the means to produce the Daily CQC Report. The Contractor may use other formats to record basic QC data. However, the Daily CQC Report generated by QCS shall be the Contractor's official report. Data from any supplemental reports by the Contractor shall be summarized and consolidated onto the QCS-generated Daily CQC Report. Daily CQC Reports shall be submitted as required by Section 01 45 04.00 10, CONTRACTOR QUALITY CONTROL. Reports shall be submitted electronically to the Government within 24 hours after the date covered by the report. The Contractor shall also provide the Government a signed, printed copy of the daily CQC report.

#### 1.7.3.2. Deficiency Tracking

The Contractor shall use QCS to track deficiencies. Deficiencies identified by the Contractor will be numerically tracked using QC punch list items. The Contractor shall maintain a current log of its QC punch list items in the QCS database. The Government will log the deficiencies it has identified using its QA punch list items. The Government's QA punch list items will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of both QC and QA punch list items.

#### 1.7.3.3. QC Requirements

The Contractor shall develop and maintain a complete list of QC testing and required structural and life safety special inspections required by the International Code Council (ICC), transferred and installed property, and user training requirements in QCS. The Contractor shall update all data on these QC requirements as work progresses, and shall promptly provide this information to the Government via QCS.

#### 1.7.3.4. Three-Phase Control Meetings

The Contractor shall maintain scheduled and actual dates and times of preparatory and initial control meetings in QCS.

#### 1.7.3.5. Labor and Equipment Hours

The Contractor shall log labor and equipment exposure hours on a daily basis. This data will be rolled up into a monthly exposure report.

#### 1.7.3.6. Accident/Safety Tracking Reporting

The Government will issue safety comments, directions, or guidance whenever safety deficiencies are observed. The Government's safety comments will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of the safety comments. In addition, the Contractor shall utilize QCS to advise the Government of any accidents occurring on the jobsite. This supplemental entry is not to be considered as a substitute for completion of mandatory notification and reports, e.g., ENG Form 3394 and OSHA Form 300.

#### 1.7.3.7. Features of Work

The Contractor shall include a complete list of the features of work in the QCS database. A feature of work may be associated with multiple pay activities. However, each pay activity (see subparagraph "Pay Activity Data" of paragraph "Finances") will only be linked to a single feature of work.

#### 1.7.3.8. Hazard Analysis

The Contractor shall use QCS to develop a hazard analysis for each feature of work included in its CQC Plan. The hazard analysis shall address any hazards, or potential hazards, that may be associated with the work

#### 1.7.4. Submittal Management

The Government will provide the submittal register form, ENG Form 4288, SUBMITTAL REGISTER, in electronic format. The Contractor and Designer of Record (DOR) shall develop and maintain a complete list of all submittals, including completion of all data columns and shall manage all submittals. Dates on which submittals are received and returned by the Government will be included in its export file to the Contractor. The Contractor shall use QCS to track and transmit all submittals. ENG Form 4025, submittal transmittal form, and the submittal register update, ENG Form 4288, shall be produced using QCS. QCS and RMS will be used to update, store and exchange submittal registers and transmittals, but will not be used for storage of actual submittals.

#### 1.7.5. Schedule

The Contractor shall develop a design and construction schedule consisting of pay activities, in accordance with Section 01 32 01.00 10, PROJECT SCHEDULE, as applicable. This schedule shall be input and maintained in the QCS database either manually or by using the Standard Data Exchange Format (SDEF) (see Section 01 32 01.00 10 PROJECT SCHEDULE). The updated schedule data shall be included with each pay request submitted by the Contractor.

##### 1.7.5.1. Import/Export of Data

QCS includes the ability to export Contractor data to the Government and to import submittal register and other Government-provided data from RMS, and schedule data using SDEF.

#### 1.8. IMPLEMENTATION

Contractor use of QCS as described in the preceding paragraphs is mandatory. The Contractor shall ensure that sufficient resources are available to maintain its QCS database, and to provide the Government with regular database updates. QCS shall be an integral part of the Contractor's management of quality control.

#### 1.9. DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM

The Government-preferred method for Contractor's submission of QCS data is by using the government's SFTP repository built into QCS export function.. Other data should be submitted using E-mail with file attachment(s). For locations where this is not feasible, the Contracting Officer may permit use of CD-ROM for data transfer. Data on CDs shall be exported using the QCS built-in export function. If used, CD-ROMs will be submitted in accordance with the following:

##### 1.9.1. File Medium

The Contractor shall submit required data on CD-ROMs. They shall conform to industry standards used in the United States. All data shall be provided in English.

##### 1.9.2. Disk Or Cd-Rom Labels

The Contractor shall affix a permanent exterior label to each diskette and CD-ROM submitted. The label shall indicate in English, the QCS file name, full contract number, contract name, project location, data date, name and telephone number of person responsible for the data.

#### 1.9.3. File Names

The files will be automatically named by the QCS software. The naming convention established by the QCS software shall not be altered in any way by the Contractor.

#### 1.10. MONTHLY COORDINATION MEETING

The Contractor shall update the QCS database each workday. At least monthly, the Contractor shall generate and submit an export file to the Government with schedule update and progress payment request. As required in Contract Clause "Payments", at least one week prior to submittal, the Contractor shall meet with the Government representative to review the planned progress payment data submission for errors and omissions.

The Contractor shall make all required corrections prior to Government acceptance of the export file and progress payment request. Payment requests accompanied by incomplete or incorrect data submittals will be returned. The Government will not process progress payments until an acceptable QCS export file is received.

#### 1.11. NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the requirements of this specification. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification.

End of Section 01 45 01.10

**SECTION 01 45 04.00 10  
CONTRACTOR QUALITY CONTROL**

**1.0 GENERAL**

1.1. REFERENCES

1.2. PAYMENT

**2.0 PRODUCTS (NOT APPLICABLE)**

**3.0 EXECUTION**

3.1. GENERAL REQUIREMENTS

3.2. QUALITY CONTROL PLAN

3.3. COORDINATION MEETING

3.4. QUALITY CONTROL ORGANIZATION

3.5. SUBMITTALS AND DELIVERABLES

3.6. CONTROL

3.7. TESTS

3.8. COMPLETION INSPECTION

3.9. DOCUMENTATION

3.10. NOTIFICATION OF NONCOMPLIANCE

## **1.0 GENERAL**

### **1.1. REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. Refer to the latest edition, as of the date of the contract solicitation.

- ASTM INTERNATIONAL (ASTM)
- ASTM D 3740 Minimum Requirements for Agencies  
Engaged in the Testing and/or Inspection  
of Soil and Rock as Used in Engineering  
Design and Construction
- ASTM E 329 Agencies Engaged in the Testing  
and/or Inspection of Materials Used in  
Construction
- U.S. ARMY CORPS OF ENGINEERS (USACE)  
ER 1110-1-12 Quality Management

### **1.2. PAYMENT**

There will be no separate payment for providing and maintaining an effective Quality Control program. Include all costs associated therewith in the applicable unit prices or lump-sum prices contained in the Contract Line Item Schedule.

## **2.0 PRODUCTS (Not Applicable)**

## **3.0 EXECUTION**

### **3.1. GENERAL REQUIREMENTS**

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause titled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product, which complies with the contract requirements. The system shall cover all design and construction operations, both onsite and offsite, and shall be keyed to the proposed design and construction sequence. The site project superintendent is responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the contract. The site project superintendent in this context shall be the highest level manager at the site, responsible for the overall site activities, including but not limited to quality and production. The site project superintendent shall maintain a physical presence at the site at all times, except as otherwise acceptable to the Contracting Officer, and shall be responsible for all construction and construction related activities at the site. Different contractors have different names for the on-site overall project supervisor. For clarification, the term "site project superintendent" refers to the Contractor's senior site representative or "on-site manager", or other similar title, as those terms are used in contract Clause 52.236-7, "Superintendence by the Contractor" and in the Division 00 Section(s) of the solicitation for this contract or task order, or elsewhere in the contract. It does not refer to a construction superintendent, unless that person is also the Contractor's permanently assigned senior site representative in charge of all on-site activities.

### **3.2. QUALITY CONTROL PLAN**

Furnish for Government review, not later than 30 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. The Government will consider an interim plan for the first 30 days of operation. Design and construction may begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. The Government will not permit work outside of the features of work included in an accepted interim plan to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started. Where the applicable Code issued by the International Code Council calls for an inspection by the Building Official, the Contractor shall include the inspections in the Quality Control Plan and shall perform the inspections. The Designer of Record shall develop a program for any special inspections required by the applicable International Codes and the Contractor shall perform these inspections, using qualified inspectors. Include the special inspection plan in the QC Plan.

### 3.2.1. Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all design and construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents subcontractors, designers of record, consultants, architect/engineers (AE), fabricators, suppliers, and purchasing agents:

3.2.1.1. A description of the quality control organization. Include a chart showing lines of authority and an acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. A CQC System Manager shall report to the project superintendent or someone higher in the contractor's organization.

3.2.1.2. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function. Also include those responsible for performing and documenting the inspections required by the International Codes and the special inspection program developed by the designer of record.

3.2.1.3. A copy of the letter to the CQC System Manager, signed by an authorized official of the firm, which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Furnish copies of these letters.

3.2.1.4. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents subcontractors, designers of record, consultants, architect engineers (AE), offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

3.2.1.5. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. Use only Government approved Laboratory facilities.

3.2.1.6. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

3.2.1.7. Procedures for tracking design and construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.

3.2.1.8. Reporting procedures, including proposed reporting formats.

3.2.1.9. A list of the definable features of work. A definable feature of work is a task, which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the coordination meeting.

3.2.1.10. A list of all inspections required by the International Codes and the special inspection program required by the code and this contract.

### 3.2.2. Additional Requirements for Design Quality Control (DQC) Plan

The following additional requirements apply to the Design Quality Control (DQC) plan:

3.2.2.1. The Contractor's QCP Plan shall provide and maintain a Design Quality Control (DQC) Plan as an effective quality control program which will assure that all services required by this design-build contract are performed and provided in a manner that meets professional architectural and engineering quality standards. As a minimum, competent, independent reviewers identified in the DQC Plan shall review all documents. Use personnel who were not involved in the design effort to produce the design to perform the independent technical review (ITR). The ITR is intended as a quality control check of the design. Include, at least, but not necessarily limited to, a review of the contract requirements (the accepted contract or task order proposal and amended RFP), the basis of design, design calculations, the design configuration management documentation and check the design documents for errors, omissions, and for coordination and design integration. The ITR team is not required to examine, compare or comment concerning alternate design solutions but should concentrate on ensuring that the design meets the contract requirements. Correct errors and deficiencies in the design documents prior to submitting them to the Government.

3.2.2.2. Include in the DQC Plan the discipline-specific checklists to be used during the design and quality control of each submittal. Submit these completed checklists at each design phase as part of the project documentation.

3.2.2.3. A Design Quality Control Manager, who has the responsibility of being cognizant of and assuring that all documents on the project have been coordinated, shall implement the DQC Plan. This individual shall be a person who has verifiable engineering or architectural design experience and is a registered professional engineer or architect. Notify the Government, in writing, of the name of the individual, and the name of an alternate person assigned to the position.

3.2.2.4. Develop and maintain effective, acceptable design configuration management (DCM) procedures to control and track all revisions to the design documents after the Interim Design Submission through submission of the As-Built documents. Include the DCM plan as a subset of the DQC Plan. See Section 'Design After Award'.

### 3.2.3. Acceptance of Plan

Government acceptance of the Contractor's plan is required prior to the start of design and construction. Acceptance is conditional and will be predicated on satisfactory performance during the design and construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

### 3.2.4. Notification of Changes

After acceptance of the CQC Plan, notify the Government in writing of any proposed change. Proposed changes are subject to Government acceptance.

### 3.3. COORDINATION MEETING

After the Postaward Conference, before start of design or construction, and prior to acceptance by the Government of the CQC Plan, the Contractor and the Government shall meet and discuss the Contractor's quality control system. Submit the CQC Plan for review a minimum of 7 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, design activities, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. The Government will prepare minutes of the meeting for signature by both parties. . The minutes shall become a part of the contract file. There may be occasions when either party will call for subsequent conferences to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

### 3.4. QUALITY CONTROL ORGANIZATION

#### 3.4.1. Personnel Requirements

The requirements for the CQC organization are a CQC System Manager, a Design Quality Manager, and sufficient number of additional qualified personnel to ensure contract compliance. The CQC organization shall also include personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly. The Contractor's CQC staff shall maintain a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure contract compliance. The CQC staff shall be subject to acceptance by the Contracting Officer. Provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly furnish complete records of all letters, material submittals, shop drawing submittals, schedules and all other project documentation to the CQC organization. The CQC organization shall be responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

#### 3.4.2. CQC System Manager

Identify as CQC System Manager an individual within the onsite work organization who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be a graduate engineer, graduate architect, or a BA/BS graduate of an ACCE accredited construction management college program. The CQC system Manager may alternately be an engineering technician with at least 2 years of college and an ICC certification as a Commercial Building Inspector (Residential Building Inspector certification will be required for Military Family Housing projects). In addition, the CQC system manager shall have a minimum of 5 years construction experience on construction similar to this contract. The CQC System Manager shall be on the site at all times during construction and shall be employed by the prime Contractor. Assign the CQC System Manager no other duties (except may also serve as Safety and Health Officer, if qualified and if allowed by Section 00 73 00, or by Section 00 73 10 if this is a task order). Identify an alternate for the CQC System Manager in the plan to serve in the event of the System Manager's absence. The requirements for the alternate shall be the same as for the designated CQC System Manager but the alternate may have other duties in addition to serving in a temporary capacity as the acting QC manager.

#### 3.4.3. CQC Personnel

3.4.3.1. In addition to CQC personnel specified elsewhere in the contract provide specialized CQC personnel to assist the CQC System Manager in accordance with paragraph titled Area Qualifications.

3.4.3.2. These individuals may be employees of the prime or subcontractor; be responsible to the CQC System Manager; **are not intended to be full time, but must be physically present at the construction site during work on their areas of responsibility**; have the necessary education and/or



experience in accordance with the experience matrix listed herein. These individuals may perform other duties but must be allowed sufficient time to perform their assigned quality control duties as described in the Quality Control Plan. **One person may cover more than one area, provided that they are qualified to perform QC activities for the designated areas below and provided that they have adequate time to perform their duties:**

#### 3.4.4. Experience Matrix

##### 3.4.4.1. Area Qualifications

3.4.4.1.1. Civil - Graduate Civil Engineer or (BA/BS) graduate in construction management with 4 years experience in the type of work being performed on this project or engineering technician with 5 yrs related experience.

3.4.4.1.2. Mechanical - Graduate Mechanical Engineer or (BA/BS) graduate in construction management with 4 yrs related experience or engineering technician with an ICC certification as a Commercial Mechanical Inspector with 5 yrs related experience.

3.4.4.1.3. Electrical - Graduate Electrical Engineer or (BA/BS) graduate in construction management with 4 yrs related experience or engineering technician with an ICC certification as a Commercial Electrical Inspector with 5 yrs related experience.

3.4.4.1.4. Structural - Graduate Structural Engineer or (BA/BS) graduate in construction management with 4 yrs related experience or person with an ICC certification as a Reinforced Concrete Special Inspector and Structural Steel and Bolting Special Inspector (as applicable to the type of construction involved) with 5 yrs related experience.

3.4.4.1.5. Plumbing - Graduate Mechanical Engineer or (BA/BS) graduate in construction management with 4 yrs related experience, or person with an ICC certification as a Commercial Plumbing Inspector with 5 yrs related experience.

3.4.4.1.6. Concrete, Pavements and Soils Materials Technician (present while performing tests) with 2 yrs experience for the appropriate area

3.4.4.1.7. Testing, Adjusting and Balancing Specialist must be a member (TAB) Personnel of AABC or an experienced technician of the firm certified by the NEBB (present while testing, adjusting, balancing).

3.4.4.1.8. Design Quality Control Manager Registered Architect or Professional Engineer (not required on the construction site)

3.4.4.1.9. Registered Fire Protection Engineer with 4 years related experience or engineering technician with 5 yrs related experience (but see requirements for Fire Protection Engineer of Record to witness final testing in Section 01 10 00, paragraph 5.10, Fire Protection).

3.4.4.1.10. QC personnel assigned to the installation of the telecommunication system or any of its components shall be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Technician Level. Submit documentation of current BICSI certification. In lieu of BICSI certification, QC personnel shall have a minimum of 5 years experience in the installation of the specified copper and fiber optic cable and components. They shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products. QC personnel shall witness and certify the testing of telecommunications cabling and equipment.

#### 3.4.5. Additional Requirement

In addition to the above experience and/or education requirements the CQC System Manager shall have completed the course entitled "Construction Quality Management for Contractors". This course is periodically offered at Location and schedule information available at <http://www.nab.usace.army.mil/contracts/cqc.htm>. Inquire of the District or Division sponsoring the course for fees and other expenses involved, if any, for attendance at this course.

#### 3.4.6. Organizational Changes

When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

### 3.5. SUBMITTALS AND DELIVERABLES

Make submittals as specified in Section 01 33 00 **SUBMITTAL PROCEDURES**. The CQC organization shall certify that all submittals and deliverables are in compliance with the contract requirements.

#### 3.6. CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. The CQC organization shall conduct at least three phases of control for each definable feature of the construction work as follows:

##### 3.6.1. Preparatory Phase

Perform this phase prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

3.6.1.1. A review of each paragraph of applicable specifications, reference codes, and standards. Make a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field at the preparatory inspection. Maintain these copies in the field, available for use by Government personnel until final acceptance of the work.

3.6.1.2. A review of the contract drawings.

3.6.1.3. A check to assure that all materials and/or equipment have been tested, submitted, and approved.

3.6.1.4. Review of provisions that have been made to provide required control inspection and testing.

3.6.1.5. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.

3.6.1.6. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

3.6.1.7. A review of the appropriate activity hazard analysis to assure safety requirements are met.

3.6.1.8. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.

3.6.1.9. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

#### 3.6.1.10. Discussion of the initial control phase.

3.6.1.11. Notify the Government at least 24 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the preparatory phase actions by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

#### 3.6.2. Initial Phase

Accomplish this phase at the beginning of a definable feature of work. Include the following actions:

3.6.2.1. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.

3.6.2.2. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.

3.6.2.3. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

3.6.2.4. Resolve all differences.

3.6.2.5. Check safety to include compliance with and upgrading of the Accident Prevention plan and activity hazard analysis. Review the activity analysis with each worker.

3.6.2.6. Notify the Government at least 24 hours in advance of beginning the initial phase. The CQC System Manager shall prepare and attach to the daily CQC report separate minutes of this phase. Indicate exact location of initial phase for future reference and comparison with follow-up phases.

3.6.2.7. Repeat the initial phase any time acceptable specified quality standards are not being met.

#### 3.6.3. Follow-up Phase

Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Conduct final follow-up checks and correct deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work.

#### 3.6.4. Additional Preparatory and Initial Phases

Conduct additional preparatory and initial phases on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

### 3.7. TESTS

#### 3.7.1. Testing Procedure

Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements and project design documents. Upon request, furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing

includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory, or establish an approved testing laboratory at the project site. The Contractor may elect to use a laboratory certified and accredited by the Concrete and cement Reference Laboratory (CCRL) or by AASHTO Materials Reference Laboratory (AMRL) for testing procedures that those organizations certify. The Contractor shall perform the following activities and record and provide the following data:

3.7.1.1. Verify that testing procedures comply with contract requirements and project design documents.

3.7.1.2. Verify that facilities and testing equipment are available and comply with testing standards.

3.7.1.3. Check test instrument calibration data against certified standards.

3.7.1.4. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

3.7.1.5. Include results of all tests taken, both passing and failing tests, recorded on the CQC report for the date taken. Include specification paragraph reference, location where tests were taken, and the sequential control number identifying the test. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

### 3.7.2. Testing Laboratories

#### 3.7.2.1. Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

#### 3.7.2.2. Capability Recheck

If the selected laboratory fails the capability check, the Government will assess the Contractor a charge of \$1,375 to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

### 3.7.3. Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

### 3.7.4. Furnishing or Transportation of Samples for Government Quality Assurance Testing

The Contractor is responsible for costs incidental to the transportation of samples or materials. Deliver samples of materials for test verification and acceptance testing by the Government to the Corps of Engineers Laboratory, f.o.b., at the following address:

- For delivery by mail:  
Field Exploration Unit or Soils Laboratory Unit  
(indicate which on shipping or mailing forms)

- Fort McHenry Yard
- Baltimore, Maryland 21230
- For other deliveries:
  - N/A
  - N/A
  - N/A
  - N/A

The area or resident office will coordinate, exact delivery location, and dates for each specific test.

### 3.8. COMPLETION INSPECTION

#### 3.8.1. Punch-Out Inspection

Near the end of the work, or any increment of the work established by a time stated in the SPECIAL CONTRACT REQUIREMENTS Clause, "Commencement, Prosecution, and Completion of Work", or by the specifications, the CQC Manager shall conduct an inspection of the work. Prepare a punch list of items which do not conform to the approved drawings and specifications and include in the CQC documentation, as required by paragraph DOCUMENTATION. The list of deficiencies shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

#### 3.8.2. Pre-Final Inspection

As soon as practicable after the notification above, the Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Correct any items noted on the Pre-Final inspection in a timely manner. Accomplish these inspections and any deficiency corrections required by this paragraph within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

#### 3.8.3. Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall attend the final acceptance inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups and major commands may also attend. The Government will formally schedule the final acceptance inspection based upon results of the Pre-Final inspection. Provide notice to the Government at least 14 days prior to the final acceptance inspection and include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

### 3.9. DOCUMENTATION

3.9.1. Maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers using

government-provided software, QCS (see Section 01 45 01.10). The report includes, as a minimum, the following information:

3.9.1.1. Contractor/subcontractor and their area of responsibility.

3.9.1.2. Operating plant/equipment with hours worked, idle, or down for repair.

3.9.1.3. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

3.9.1.4. Test and/or control activities performed with results and references to specifications/drawings requirements. Identify the applicable control phase (Preparatory, Initial, Follow-up). List deficiencies noted, along with corrective action.

3.9.1.5. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.

3.9.1.6. Submittals and deliverables reviewed, with contract reference, by whom, and action taken.

3.9.1.7. Offsite surveillance activities, including actions taken.

3.9.1.8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

3.9.1.9. Instructions given/received and conflicts in plans and/or specifications.

3.9.1.10. Provide documentation of design quality control activities. For independent design reviews, provide, as a minimum, identity of the ITR team, the ITR review comments, responses and the record of resolution of the comments.

3.9.2. Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. Furnish the original and one copy of these records in report form to the Government daily within 24 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, submit one report for every 7 days of no work and on the last day of a no work period. Account for all calendar days throughout the life of the contract. The first report following a day of no work shall be for that day only. The CQC System Manager shall sign and date reports. The report shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel. The Contractor may submit these forms electronically, in lieu of hard copy.

### 3.10. NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

End of Section 01 45 04.00 10

**SECTION 01 50 02**  
**TEMPORARY CONSTRUCTION FACILITIES**

**1.0 OVERVIEW**

- 1.1. GENERAL REQUIREMENTS
- 1.2. AVAILABILITY AND USE OF UTILITY SERVICES
- 1.3. BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN
- 1.4. PROTECTION AND MAINTENANCE OF TRAFFIC
- 1.5. MAINTENANCE OF CONSTRUCTION SITE



## 1.0 OVERVIEW

### 1.1. GENERAL REQUIREMENTS

#### 1.1.1. Site Plan

Prepare a site plan indicating the proposed location and dimensions of any area to be fenced and used by the Contractor, the number of trailers to be used, avenues of ingress/egress to the fenced area and details of the fence installation. Identify any areas which may have to be graveled to prevent the tracking of mud. Also indicate if the use of a supplemental or other staging area is desired.

### 1.2. AVAILABILITY AND USE OF UTILITY SERVICES

1.2.1. See Section 00 72 00, Contract Clauses and Section 00 73 00, Special Contract Requirements, for Utility Availability requirements.

#### 1.2.2. Sanitation

Provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer. Government toilet facilities will not be available to Contractor's personnel.

#### 1.2.3. Telephone

Make arrangements and pay all costs for desired telephone facilities.

### 1.3. BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN

#### 1.3.1. Bulletin Board

Immediately upon beginning of onsite work, provide a weatherproof glass-covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer. Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer. Display legible copies of the aforementioned data until work is completed. Remove the bulletin board from the site upon completion of the project.

#### 1.3.2. Project and Safety Signs

Erect a project sign and a site safety sign with informational details as provided by the Government at the Post award conference, within 15 days prior to any work activity on project site. Update the safety sign data daily, with light colored metallic or non-metallic numerals. Remove the signs from the site upon completion of the project. Engineer Pamphlet EP 310-1-6a contains the standardized layout and construction details for the signs. It can be found through a GOOGLE Search or try the US Army Corps of Engineers Techinfo Website at <http://www.hnd.usace.army.mil/techinfo/>. Click on Publications then go to Engineer Pamphlets and select EP 310-1-6a.

### 1.4. PROTECTION AND MAINTENANCE OF TRAFFIC

Provide access and temporary relocated roads as necessary to maintain traffic. Maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Take measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment and the work, and the erection and maintenance of adequate warning, danger, and direction signs, as required by the State and local authorities having jurisdiction. Protect the traveling public from damage to person and property.

The Contractor's traffic on roads selected for hauling material to and from the site shall interfere as little as possible with public traffic. Investigate the adequacy of existing roads and the allowable load limit on these roads. Repair any damage to roads caused by construction operations.

#### 1.4.1. Haul Roads

The Contractor shall, at its own expense, construct access and haul roads necessary for proper prosecution of the work under this contract. Construct haul roads with suitable grades and widths. Avoid sharp curves, blind corners, and dangerous cross traffic. Provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, shall be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads shall be subject to approval by the Contracting Officer. Provide adequate lighting to assure full and clear visibility for full width of haul road and work areas during any night work operations. Remove haul roads designated by the Contracting Officer upon completion of the work and restore those areas.

#### 1.4.2. Barricades

Erect and maintain temporary barricades to limit public access to hazardous areas. Barricades shall be required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

#### 1.5. MAINTENANCE OF CONSTRUCTION SITE

Mow grass and vegetation located within the boundaries of the construction site for the duration of the project, from NTP to contract completion. Edge or neatly trim grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers from NTP to contract completion.

End of Section 01 50 02

**SECTION 01 57 20.00 10  
ENVIRONMENTAL PROTECTION**

**1.0 GENERAL REQUIREMENTS**

- 1.1. SUBCONTRACTORS
- 1.2. ENVIRONMENTAL PROTECTION PLAN
- 1.3. PROTECTION FEATURES
- 1.4. ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS
- 1.5. NOTIFICATION

**2.0 PRODUCTS (NOT USED)**

**3.0 EXECUTION**

- 3.1. LAND RESOURCES
- 3.2. WATER RESOURCES
- 3.3. AIR RESOURCES
- 3.4. CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL
- 3.5. RECYCLING AND WASTE MINIMIZATION
- 3.6. HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES
- 3.7. BIOLOGICAL RESOURCES
- 3.8. INTEGRATED PEST MANAGEMENT
- 3.9. PREVIOUSLY USED EQUIPMENT
- 3.10. MILITARY MUNITIONS
- 3.11. TRAINING OF CONTRACTOR PERSONNEL
- 3.12. POST CONSTRUCTION CLEANUP

## 1.0 GENERAL REQUIREMENTS

Minimize environmental pollution and damage that may occur as the result of construction operations. Protect the environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire duration of this contract. Comply with all applicable environmental Federal, State, and local laws and regulations. The Contractor shall be responsible for any delays resulting from failure to comply with environmental laws and regulations

### 1.1. SUBCONTRACTORS

Ensure compliance with this section by subcontractors.

### 1.2. ENVIRONMENTAL PROTECTION PLAN

1.2.1. The purpose of the Environmental Protection Plan is to present a comprehensive overview of known or potential environmental issues which the Contractor must address during construction. Define issues of concern within the Environmental Protection Plan as outlined in this section. Address each topic in the plan at a level of detail commensurate with the environmental issue and required construction task(s). Identify and discuss topics or issues which are not identified in this section, but which the Contractor considers necessary, after those items formally identified in this section. Prior to commencing construction activities or delivery of materials to the site, submit the Plan for review and Government approval. The Contractor shall meet with the Government prior to implementation of the Environmental Protection Plan, for the purpose of discussing the implementation of the initial plan; possible subsequent additions and revisions to the plan including any reporting requirements; and methods for administration of the Contractor's Environmental Plans. Maintain and keep the Environmental Protection Plan current onsite.

#### 1.2.2. Compliance

No requirement in this Section shall be construed as relieving the Contractor of any applicable Federal, State, and local environmental protection laws and regulations. During Construction, the Contractor shall be responsible for identifying, implementing, and submitting for approval any additional requirements to be included in the Environmental Protection Plan.

#### 1.2.3. Contents

The plan shall include, but shall not be limited to, the following:

1.2.3.1. Name(s) of person(s) within the Contractor's organization who is(are) responsible for ensuring adherence to the Environmental Protection Plan.

1.2.3.2. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site, if applicable

1.2.3.3. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel

1.2.3.4. Description of the Contractor's environmental protection personnel training program

1.2.3.5. An erosion and sediment control plan which identifies the type and location of the erosion and sediment controls to be provided. Include monitoring and reporting requirements to assure that the control measures are in compliance with the erosion and sediment control plan, Federal, State, and local laws and regulations. A Storm Water Pollution Prevention Plan (SWPPP) may be substituted for this plan.

1.2.3.6. Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on the site

1.2.3.7. Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Include measures to minimize the amount of mud transported onto paved public roads by vehicles or runoff.

1.2.3.8. Work area plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Include measures for marking the limits of use areas including methods for protection of features to be preserved within authorized work areas.

1.2.3.9. Drawing showing the location of on-installation borrow areas.

1.2.3.10. A spill control plan shall include the procedures, instructions, and reports to be used in the event of an unforeseen spill of a substance regulated by 40 CFR 68, 40 CFR 302, 40 CFR 355, and/or regulated under State or Local laws and regulations. The spill control plan supplements the requirements of EM 385-1-1. This plan shall include as a minimum:

(a) The name of the individual who will report any spills or hazardous substance releases and who will follow up with complete documentation. This individual shall immediately notify the Government and the local Fire Department in addition to the legally required Federal, State, and local reporting channels (including the National Response Center 1-800-424-8802) if a reportable quantity is released to the environment. The plan shall contain a list of the required reporting channels and telephone numbers.

(b) The name and qualifications of the individual who will be responsible for implementing and supervising the containment and cleanup

(c) Training requirements for Contractor's personnel and methods of accomplishing the training

(d) A list of materials and equipment to be immediately available at the job site, tailored to cleanup work of the potential hazard(s) identified.

(e) The names and locations of suppliers of containment materials and locations of additional fuel oil recovery, cleanup, restoration, and material-placement equipment available in case of an unforeseen spill emergency

(f) The methods and procedures to be used for expeditious contaminant cleanup

1.2.3.11. A solid waste management plan identifying waste minimization, collection, and disposals methods, waste streams (type and quantity), and locations for solid waste diversion/disposal including clearing debris and C&D waste that is diverted (salvaged, reused, or recycled). Detail the contractor's actions to comply with, and to participate in, Federal, state, regional, local government, and installation sponsored recycling programs to reduce the volume of solid waste at the source. Identify any subcontractors responsible for the transportation, salvage and disposal of solid waste. Submit licenses or permits for solid waste disposal sites that are not a commercial operating facility. Attach evidence of the facility's ability to accept the solid waste to this plan. A construction and demolition waste management plan, similar to the plan specified in the UFGS 01 74 19 (formerly 01572) may be used as the non-hazardous solid waste management plan. Provide a Non-Hazardous Solid Waste Diversion Report. Submit the report on the first working day after the first quarter that non-hazardous solid waste has been disposed and/or diverted and each quarter thereafter (e.g. the first working day of January, April, July, and October) until the end of the project. Additionally, a summary report, with all data fields, is required at the end of the project. The report shall indicate the total type and amount of waste generated, total type and amount of waste diverted, type and amount of waste sent to waste-to-energy facility and alternative daily cover, in tons along with the percent that was diverted. Maintain, track and report construction and demolition waste data in a manner such that the installation can enter the data into the Army SWAR database, which separates data by type of material. A cumulative report in LEED Letter Template format may be used but must be modified to include the date disposed of/diverted and include

the above stated diversion data. NOTE: The Solid Waste Diversion Reports are separate documentation than the LEED documentation.

1.2.3.12. DELETED.

1.2.3.13. An air pollution control plan detailing provisions to assure that dust, debris, materials, trash, etc., do not become air borne and travel off the project site.

1.2.3.14. A contaminant prevention plan that: identifies potentially hazardous substances to be used on the job site; identifies the intended actions to prevent introduction of such materials into the air, water, or ground; and details provisions for compliance with Federal, State, and local laws and regulations for storage and handling of these materials. In accordance with EM 385-1-1, include a copy of the Material Safety Data Sheets (MSDS) and the maximum quantity of each hazardous material to be on site at any given time in the contaminant prevention plan. Update the plan as new hazardous materials are brought on site or removed from the site. Reference this plan in the storm water pollution prevention plan, as applicable.

1.2.3.15. A waste water management plan that identifies the methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines. If a settling/retention pond is required, include the design of the pond including drawings, removal plan, and testing requirements for possible pollutants. If land application will be the method of disposal for the waste water, include a sketch showing the location for land application along with a description of the pretreatment methods to be implemented and any required permits. If surface discharge will be the method of disposal, include a copy of the permit and associated documents as an attachment prior to discharging the waste water. If disposal is to a sanitary sewer, include documentation that the waste water treatment plant Operator has approved the flow rate, volume, and type of discharge.

1.2.3.16. A historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on the project site: and/or identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in the area are discovered during construction. Include methods to assure the protection of known or discovered resources and shall identify lines of communication between Contractor personnel and the Government.

1.2.3.17. A pesticide treatment plan, updated, as information becomes available. Include: sequence of treatment, dates, times, locations, pesticide trade name, EPA registration numbers, authorized uses, chemical composition, formulation, original and applied concentration, application rates of active ingredient (i.e. pounds of active ingredient applied), equipment used for application and calibration of equipment. The Contractor is responsible for Federal, State, Regional and Local pest management record keeping and reporting requirements as well as any additional Installation specific requirements. Follow AR 200-1, Chapter 5, Pest Management, Section 5-4, "Program Requirements" for data required to be reported to the Installation.

### 1.3. PROTECTION FEATURES

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS. Prior to start of any onsite construction activities, the Contractor and the Government shall make a joint condition survey. Immediately following the survey, the Contractor shall prepare a brief report including a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. Both the Contractor and the Government will

sign this survey, upon mutual agreement as to its accuracy and completeness. The Contractor develop a plan that depicts how it will protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference which their preservation may cause to the Contractor's work under the contract.

#### 1.4. ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS

Any deviations, requested by the Contractor, from the drawings, plans and specifications which may have an environmental impact will be subject to approval by the Government and may require an extended review, processing, and approval time. The Government reserves the right to disapprove alternate methods, even if they are more cost effective, if the Government determines that the proposed alternate method will have an adverse environmental impact.

#### 1.5. NOTIFICATION

The Government will notify the Contractor in writing of any observed noncompliance with Federal, State or local environmental laws or regulations, permits, and other elements of the Contractor's Environmental Protection plan. The Contractor shall, after receipt of such notice, inform the Government of the proposed corrective action and take such action when approved by the Government. The Government may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or equitable adjustments allowed to the Contractor for any such suspensions. This is in addition to any other actions the Government may take under the contract, or in accordance with the Federal Acquisition Regulation or Federal Law.

### 2.0 PRODUCTS (NOT USED)

### 3.0 EXECUTION

#### 3.1. LAND RESOURCES

Confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction, identify any land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without approval. Do not attach or fasten any ropes, cables, or guys to any trees for anchorage unless specifically authorized. Provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Remove all stone, soil, or other materials displaced into uncleared areas..

##### 3.1.1. Work Area Limits

Prior to commencing construction activities, mark the areas that need not be disturbed under this contract. Mark or fence isolated areas within the general work area which are not to be disturbed. Protect monuments and markers before construction operations commence. Where construction operations are to be conducted during darkness, any markers shall be visible in the dark. Personnel shall be knowledgeable of the purpose for marking and/or protecting particular objects.

##### 3.1.2. Landscape

Clearly identify trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved by marking, fencing, or wrapping with boards, or any other approved techniques. Restore landscape features damaged or destroyed during construction operations outside the limits of the approved work area.

##### 3.1.3. Erosion and Sediment Controls

Provide erosion and sediment control measures in accordance with Federal, State, and local laws and regulations. Coordinate with approving authorities (federal, state, etc.) for specific requirements to be included in the plan. The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's construction activities. Keep the area of bare soil exposed at any one time by construction operations to a minimum necessary. Construct or install temporary and permanent erosion and sediment control best management practices (BMPs). BMPs may include, but not be limited to, vegetation cover, stream bank stabilization, slope stabilization, silt fences, construction of terraces, interceptor channels, sediment traps, inlet and outfall protection, diversion channels, and sedimentation basins. Remove any temporary measures after the area has been stabilized.

#### 3.1.4. Contractor Facilities and Work Areas

Place field offices, staging areas, stockpile storage, and temporary buildings in areas designated on the drawings or as directed by the Government. Make only approved temporary movement or relocation of Contractor facilities. Provide erosion and sediment controls for on-site borrow and spoil areas to prevent sediment from entering nearby waters. Control temporary excavation and embankments for plant and/or work areas to protect adjacent areas.

### 3.2. WATER RESOURCES

Monitor construction activities to prevent pollution of surface and ground waters. Do not apply toxic or hazardous chemicals to soil or vegetation unless otherwise indicated. Monitor all water areas affected by construction activities. For construction activities immediately adjacent to impaired surface waters, the Contractor shall be capable of quantifying sediment or pollutant loading to that surface water when required by state or federally issued Clean Water Act permits.

#### 3.2.1. Stream Crossings

Stream crossings shall allow movement of materials or equipment without violating water pollution control standards of the Federal, State, and local governments or impede state-designated flows.

#### 3.2.2. Wetlands

Do not enter, disturb, destroy, or allow discharge of contaminants into any wetlands.

### 3.3. AIR RESOURCES

Comply with all Federal and State air emission and performance laws and standards for equipment operation, activities, or processes.

#### 3.3.1. Particulates

Control dust particles; aerosols and gaseous by-products from construction activities; and processing and preparation of materials, such as from asphaltic batch plants, including weekends, holidays and hours when work is not in progress. Maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates which would cause the Federal, State, and local air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators or other methods are permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. Provide sufficient, competent equipment available to accomplish these tasks. Perform particulate control as the work proceeds and whenever a particulate nuisance or hazard occurs. Comply with all State and local visibility regulations.



### 3.3.2. Odors

Control odors from construction activities at all times. Odors shall not cause a health hazard and shall be in compliance with State regulations and/or local ordinances.

### 3.3.3. Sound Intrusions

Keep construction activities under surveillance and control to minimize environment damage by noise. Comply with the provisions of the state and Installation rules.

### 3.3.4. Burning

Burning is not allowed on the project site unless specified in other sections of the specifications or by written authorization. Specific times, locations, and manners of burning shall be subject to approval.

## 3.4. CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL

Disposal of wastes shall be as directed below, unless otherwise specified in other sections and/or shown on the drawings.

### 3.4.1. Solid Wastes

Place solid wastes (excluding clearing debris) in containers which are emptied on a regular schedule. Conduct handling, storage, and disposal to prevent contamination. Employ segregation measures so that no hazardous or toxic waste will become co-mingled with solid waste. Transport solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal. The minimum acceptable off-site solid waste disposal option is a Subtitle D RCRA permitted landfill. Verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. Comply with Federal, State, and local laws and regulations pertaining to the use of landfill areas.

### 3.4.2. Chemicals and Chemical Wastes

Dispense chemicals, ensuring no spillage to the ground or water. Perform and document periodic inspections of dispensing areas to identify leakage and initiate corrective action. The Government may periodically review this documentation. Collect chemical waste in corrosion resistant, compatible containers. Monitor and remove collection drums to a staging or storage area when contents are within 6 inches of the top. Classify, manage, store, and dispose of wastes in accordance with Federal, State, and local laws and regulations.

### 3.4.3. Contractor Generated Hazardous Wastes/Excess Hazardous Materials

Hazardous wastes are defined in 40 CFR 261, or are as defined by applicable state and local regulations. Hazardous materials are defined in 49 CFR 171 - 178. At a minimum, manage and store hazardous waste in compliance with 40 CFR 262. Take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing. Segregate hazardous waste from other materials and wastes; protect it from the weather by placing it in a safe covered location and take precautionary measures, such as berming or other appropriate measures, against accidental spillage. Store, describe, package, label, mark, and placard hazardous waste and hazardous material in accordance with 49 CFR 171 - 178, state, and local laws and regulations. Transport Contractor generated hazardous waste off Government property in accordance with the Environmental Protection Agency and the Department of Transportation laws and regulations. Dispose of hazardous waste in compliance with Federal, State and local laws and regulations. Immediately report spills of hazardous or toxic materials to the Government and the Facility Environmental Office. Contractor will be responsible for cleanup and cleanup costs due to spills.

Contractor is responsible for the disposition of Contractor generated hazardous waste and excess hazardous materials.

#### 3.4.4. Fuel and Lubricants

Conduct storage, fueling and lubrication of equipment and motor vehicles in a manner that affords the maximum protection against spill and evaporation. Manage and store fuel, lubricants and oil in accordance with all Federal, State, Regional, and local laws and regulations.

### 3.5. RECYCLING AND WASTE MINIMIZATION

Participate in State and local government sponsored recycling programs. The Contractor is further encouraged to minimize solid waste generation throughout the duration of the project. Line and berm fueling areas and establish storm water control structures at discharge points for site run-off. Keep a liquid containment clean-up kit available at the fueling area.

### 3.6. HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Existing historical, archaeological, and cultural resources within the Contractor's work area are shown on the drawings. Protect and preserve these resources during the life of the Contract. Temporarily suspend all activities that may damage or alter such resources, if any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found during excavation or other construction activities. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, notify the Government so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. Cease all activities that may result in impact to or the destruction of these resources. Secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources.

### 3.7. BIOLOGICAL RESOURCES

Minimize interference with, disturbance to, and damage to fish, wildlife, and plants, including their habitat. Protect threatened and endangered animal and plant species including their habitat in accordance with Federal, State, Regional, and local laws and regulations.

### 3.8. INTEGRATED PEST MANAGEMENT

Coordinate, through the Government, with the Installation Pest Management Coordinator (IPMC) at the earliest possible time prior to pesticide application, in order to minimize impacts to existing fauna and flora. Discuss integrated pest management strategies with the IPMC and receive concurrence from the IPMC, through the COR, prior to the application of any pesticide associated with these specifications. Give IPMC personnel the opportunity to be present at all meetings concerning treatment measures for pest or disease control and during application of the pesticide. The use and management of pesticides are regulated under 40 CFR 152 - 186.

#### 3.8.1. Pesticide Delivery and Storage

Deliver pesticides, approved for use on the Installation, to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses.

#### 3.8.2. Qualifications

Use the services of a subcontractor for pesticide application whose principal business is pest control. The subcontractor shall be licensed and certified in the state where the work is to be performed.

#### 3.8.3. Pesticide Handling Requirements

Formulate, treat with, and dispose of pesticides and associated containers in accordance with label directions.

#### 3.8.4. Application

A state certified pesticide applicator shall apply pesticides in accordance with EPA label restrictions and recommendations.

#### 3.9. PREVIOUSLY USED EQUIPMENT

Clean all previously used construction equipment prior to bringing it onto the project site. Ensure that the equipment is free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds. Consult with the USDA jurisdictional office for additional cleaning requirements.

#### 3.10. MILITARY MUNITIONS

Immediately stop work in that area and immediately inform the Government, in the event military munitions, as defined in 40 CFR 260, are discovered or uncovered.

#### 3.11. TRAINING OF CONTRACTOR PERSONNEL

Train personnel in all phases of environmental protection and pollution control. Conduct environmental protection/pollution control meetings for all Contractor personnel prior to commencing construction activities. Conduct additional meetings for new personnel and when site conditions change. The training and meeting agenda shall include methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, wetlands, and endangered species and their habitat that are known to be in the area.

#### 3.12. POST CONSTRUCTION CLEANUP

Clean up all areas used for construction in accordance with Contract Clause: "Cleaning Up". Unless otherwise instructed in writing, obliterate all signs of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. Grade, fill and seed the entire disturbed area, unless otherwise indicated.

**SECTION 01 62 35  
RECYCLED/RECOVERED MATERIAL**

**1.0 GENERAL**

1.1. REFERENCES

1.2. OBJECTIVES

1.3. EPA DESIGNATED ITEMS INCORPORATED IN THE WORK

1.4. EPA PROPOSED ITEMS INCORPORATED IN THE WORK

1.5. EPA LISTED ITEMS USED IN CONDUCT OF THE WORK BUT NOT INCORPORATED IN THE WORK

## **1.0 GENERAL**

### **1.1. REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

- U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
- 40 CFR 247 Comprehensive Procurement Guideline for Products Containing Recovered Materials

### **1.2. OBJECTIVES**

Government procurement policy is to acquire, in a cost effective manner, items containing the highest percentage of recycled and recovered materials practicable consistent with maintaining a satisfactory level of competition without adversely affecting performance requirements or exposing suppliers' employees to undue hazards from the recovered materials. The Environmental Protection Agency (EPA) has designated certain items which must contain a specified percent range of recovered or recycled materials. The Contractor shall make all reasonable efforts to use recycled and recovered materials in providing the EPA designated products and in otherwise utilizing recycled and recovered materials in the execution of the work.

### **1.3. EPA DESIGNATED ITEMS INCORPORATED IN THE WORK**

Materials that have been designated by EPA as being products which are or can be made with recovered or recycled materials, when incorporated into the work under this contract, shall contain at least the minimum percentage of recycled or recovered materials indicated by EPA unless adequate justification (non-availability) for non-use is provided. When a designated item is specified as an option to a non-designated item, the designated item requirements apply only if the designated item is used in the work.

### **1.4. EPA PROPOSED ITEMS INCORPORATED IN THE WORK**

Products other than those designated by EPA are still being researched and are being considered for future Comprehensive Procurement Guideline (CPG) designation. It is recommended that these items, when incorporated in the work under this contract, contain the highest practicable percentage of recycled or recovered materials, provided specified requirements are also met.

### **1.5. EPA LISTED ITEMS USED IN CONDUCT OF THE WORK BUT NOT INCORPORATED IN THE WORK**

There are many products listed in 40 CFR 247 which have been designated or proposed by EPA to include recycled or recovered materials that may be use by the Contractor in performing the work but will not be incorporated into the work. These products include office products, temporary traffic control products, and pallets. It is recommended that these non-construction products, when used in the conduct of the work, contain the highest practicable percentage of recycled or recovered materials and that these products be recycled when no longer needed.

End of Section 01 62 35

**SECTION 01 78 02.00 10  
CLOSEOUT SUBMITTALS**

**1.0 OVERVIEW**

- 1.1. SUBMITTALS
- 1.2. PROJECT RECORD DOCUMENTS
- 1.3. EQUIPMENT DATA
- 1.4. CONSTRUCTION WARRANTY MANAGEMENT
- 1.5. MECHANICAL TESTING, ADJUSTING, BALANCING, AND COMMISSIONING
- 1.6. OPERATION AND MAINTENANCE MANUALS
- 1.7. FIELD TRAINING
- 1.8. PRICING OF CONTRACTOR-FURNISHED AND INSTALLED PROPERTY AND GOVERNMENT-FURNISHED CONTRACTOR-INSTALLED PROPERTY
- 1.9. LEED REVIEW MEETINGS
- 1.10. RED ZONE MEETING
- 1.11. FINAL CLEANING
- 1.12. INTERIM FORM DD1354 "TRANSFER AND ACCEPTANCE OF MILITARY REAL PROPERTY

**EXHIBIT 1 SAMPLE RED ZONE MEETING CHECKLIST**

## 1.0 OVERVIEW

### 1.1. SUBMITTALS

Government approval is required for any submittals with a "G" designation; submittals not having a "G" designation are for Designer of Record approval or for information only. Submit the following in accordance with Section 01 33 00 submittals:

#### SD-02 Shop Drawings

- As-Built Drawings - G
  - Drawings showing final as-built conditions of the project. Provide electronic drawing files as specified in Section 01 33 16, 3 sets of blue-line prints and one set of the approved working as-built drawings.

#### SD-03 Product Data

- As-Built Record of Equipment and Materials
  - Two copies of the record listing the as-built materials and equipment incorporated into the construction of the project.
- Construction Warranty Management Plan
  - Three sets of the construction warranty management plan containing information relevant to the warranty of materials and equipment incorporated into the construction project, including the starting date of warranty of construction. Furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.
- Warranty Tags
  - Two record copies of the warranty tags showing the layout and design.
- Final Cleaning
  - Two copies of the listing of completed final clean-up items.

### 1.2. PROJECT RECORD DOCUMENTS

#### 1.2.1. As-Built Drawings – G

An as-built drawing is a construction drawing revised to reflect the final as-built conditions of the project as a result of modifications and corrections to the project design required during construction. The final as-built drawings shall not have the appearance of marked up drawings, but that of professionally prepared drawings as if they were the "as designed" drawings.

#### 1.2.2. Maintenance of As-Built Drawings

1.2.2.1. The Configuration Management Plan shall describe how the Contractor will maintain up-to-date drawings, how it will control and designate revisions to the drawings and specifications (In accordance with Special Contract Requirement: ***Deviating from the Accepted Design*** and Section 01 33 16: ***Design after Award***, the Designer of Record's approval is necessary for any revisions to the accepted design).

1.2.2.2. Make timely updates, carefully maintaining a record set of working as-built drawings at the job site, marked in red, of all changes and corrections from the construction drawings. Enter changes and corrections on drawings promptly to reflect "Current Construction". Perform this update no less frequently

than weekly for the blue line drawings and update no less frequently than quarterly for the CADD/CAD and BIM files, which were prepared previously in accordance with Section 01 33 16. Include a confirmation that the as-builts are up to date with the submission of the monthly project schedule.

1.2.2.3. If the DB Contractor fails to maintain the as-built drawings as required herein, the Government will retain from the monthly progress payment, an amount representing the estimated monthly cost of maintaining the as-built drawings. Final payment with respect to separately priced facilities or the contract as a whole will be withheld until the Contractor submits acceptable as-built drawings and the Government approves them.

1.2.2.4. The marked-up set of drawings shall reflect any changes, alterations, adjustments or modifications. Changes must be reflected on all sheets affected by the change. Changes shall include marking the drawings to reflect structural details, foundation layouts, equipment sizes, and other extensions of design.

1.2.2.5. Typically, room numbers shown on the drawings are selected for design convenience and do not represent the actual numbers intended for use by the end user. Final as-built drawings shall reflect actual room numbers adopted by the end user.

1.2.2.6. If there is no separate contract line item (CLIN) for as-built drawings, the Government will withhold the amount of \$35,000, or 1% of the present construction value, whichever is the greater, until the final as-built drawing submittal has been approved by the Government.

### 1.2.3. Underground Utilities

The drawings shall indicate, in addition to all changes and corrections, the actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, the as-built drawings shall show, by offset dimensions to two permanently fixed surface features, the end of each run including each change in direction. Locate Valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Record average elevation of the top of each run or underground structure..

### 1.2.4. Partial Occupancy

For projects where portions of construction are to be occupied or activated before overall project completion, including portions of utility systems, supply as-built drawings for those portions of the facility being occupied or activated at the time the facility is occupied or activated. Show this same as-built information previously furnished on the final set of as-built drawings.

### 1.2.5. As-Built Conditions That are Different From the construction Drawings

Accurately reflect all as-built conditions that are different, such as dimensions, road alignments and grades, and drainage and elevations, from the construction drawings on each drawing. If the as-built condition is accurately reflected on a shop drawing, then furnish that shop drawing in CADD format. Reference the final as-built construction drawing the shop drawing file that includes the as-built information. In turn, the shop drawing shall reference the applicable construction as-built drawing. Delete any options shown on drawings and not selected clearly reflect options selected on final as-built drawings.

### 1.2.6. Additional As-Built Information that Exceeds the Detail Shown on the construction Drawings:

These as-built conditions include those that reflect structural details, foundation layouts, equipment, sizes, mechanical and electrical room layouts and other extensions of design, that were not shown in the project design documents because the exact details were not known until after the time of approved shop



drawings. It is recognized that these shop drawing submittals (revised showing as-built conditions) will serve as the as-built record without actual incorporation into the construction drawings, piping, and equipment drawings. Include locations of all explorations, logs of all explorations, and results of all laboratory testing, including those provided by the Government. Furnish all such shop drawings in CADD /CADformat. Include fire protection details, such as wiring, performed for the design of the project.

#### 1.2.7. Final As-Built Drawings

Submit final as-built CADD/CAD and BIM Model(s) and Facility Data files at the time of Beneficial Occupancy of the project or at a designated phase of the project. In the event the Contractor accomplishes additional work after this submittal, which changes the as-built conditions, submit a new DVD with all drawing sheets and three blue-line copies of affected sheets which depict additional changes.

#### 1.2.8. Title Blocks

In accordance with the configuration management plan, clearly mark title blocks to indicate final as-built drawings.

#### 1.2.9. Other As-Built Documents

Provide scans of all other documents such as design analysis, catalog cuts, certification documents that are not available in native electronic format in an organized manner in Adobe.pdf format.

##### 1.2.9.1. LEED Documentation

Update LEED documentation on at least a monthly basis and have it available for review by the Government on the jobsite at all times during construction. Submit the final LEED Project Checklist(s), final LEED submittals checklist and complete project documentation, verifying the final LEED score and establishing the final rating. Provide full support to the validation review process, including credit audits. See also the LEED documentation requirements in Section 01 33 16, DESIGN AFTER AWARD.

##### 1.2.9.2. GIS Documentation

Provide final geo-referenced GIS database of the new building footprint along with any changes made to exterior of the building. The intent of capturing the final building footprint and exterior modifications in a GIS database is to provide the installation with a data set of the comprehensive changes made to the landscape as a result of the construction project. The Government will incorporate this data set into the installations existing GIS MasterPlan or Enterprise GIS system. The GIS database deliverable shall follow a standard template provided to the Contractor by the Government, adhere to detailed specifications outlined in ECB No 2006-15, and be documented using the Federal Geographic Data Committee (FGDC) metadata standard.

### 1.3. EQUIPMENT DATA

#### 1.3.1. Real Property Equipment

Provide an Equipment-in-Place list of all installed equipment furnished under this contract. Include all information usually listed on manufacturer's name plate. Include the cost of each piece of installed property F.O.B. construction site. For each of the items which is specified herein to be guaranteed for a specified period from the date of acceptance thereof, provide the following information: The name, serial and model number address of equipment supplier, or manufacturer originating the guaranteed item. The Contractor's guarantee to the Government of these items will not be limited by the terms of any manufacturer's guarantee to the Contractor. Furnish the list as one (1) reproducible and three (3) copies

thirty (30) calendar days before completion of any segment of the contract work which has an incremental completion date.

#### 1.3.2. Maintenance and Parts Data

Furnish a brochure, catalog cut, parts list, manufacturer's data sheet or other publication showing detailed parts data on all other equipment subject to repair and maintenance procedures not otherwise required in Operations and Maintenance Manuals specified elsewhere in this contract. Distribution of directives shall follow the same requirements as listed in paragraph above.

#### 1.3.3. Construction Specifications

Furnish permanent electronic files of final as-built construction specifications, including modifications thereto, with the as-built drawings.

#### 1.4. CONSTRUCTION WARRANTY MANAGEMENT

1.4.1. Prior to the end of the one year warranty, the Government may conduct an infrared roof survey on any project involving a membrane roofing system. This survey will be conducted in accordance with ASTM C1153-90, "Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging". The Contractor shall replace all damaged materials and locate and repair sources of moisture penetration.

#### 1.4.2. Management

##### 1.4.2.1. Warranty Management Plan

Develop a warranty management plan containing information relevant to the clause **Warranty of Construction** in FAR 52.246-21. Submit the warranty management plan for Government approval at least 30 days before the planned pre-warranty conference. In the event of phased turn-over of the contract, update the Warranty Management Plan as necessary to include latest information required. Include all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan shall be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below shall include due date and whether item has been submitted or was accomplished. Submit warranty information made available during the construction phase prior to each monthly pay estimate. Assemble information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period shall begin on the date of project acceptance and shall continue for the full product warranty period. The Contractor, Government, including the Customer Representative shall jointly conduct warranty inspections, 4 months and 9 months, after acceptance. The warranty management plan shall include, but shall not be limited to, the following information:

- (1) Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the contractors, subcontractors, manufacturers or suppliers involved.
- (2) Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.
- (3) A list for each warranted equipment, item, feature of construction or system indicating:
  - (i) Name of item.
  - (ii) Model and serial numbers.
  - (iii) Location where installed.

- (iv) Name and phone numbers of manufacturers or suppliers.
- (v) Names, addresses and telephone numbers of sources of spare parts.
- (vi) Warranties and terms of warranty. Include one-year overall warranty of construction. Indicate those items, which have extended warranties with separate warranty expiration dates.
- (vii) Cross-reference to warranty certificates as applicable.
- (viii) Starting point and duration of warranty period.
- (ix) Summary of maintenance procedures required to continue the warranty in force.
- (x) Cross-reference to specific pertinent Operation and Maintenance manuals.
- (xi) Organization, names and phone numbers of persons to call for warranty service.
- (xii) Typical response time and repair time expected for various warranted equipment.
- (4) The Contractor's plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.
- (5) Procedure and status of tagging of all equipment covered by extended warranties.
- (6) Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

#### 1.4.3. Performance Bond

1.4.3.1. The Contractor's Performance Bond will remain effective throughout the construction warranty period.

1.4.3.2. In the event the Contractor or his designated representative(s) fails to commence and diligently pursue any work required under this clause, and in a manner pursuant to the requirements thereof, the Government shall have a right to demand that said work be performed under the Performance Bond by making written notice on the surety. If the surety fails or refuses to perform the obligation it assumed under the Performance Bond, the Government shall have the work performed by others, and after completion of the work, may make demand for reimbursement of any or all expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

1.4.3.3. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Government will have the right to recoup expenses from the bonding company.

1.4.3.4. Following oral or written notification of required warranty repair work, the Contractor will respond as dictated by para. 1.4.5. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Government to proceed against the Contractor as outlined in the paragraph 1.4.5.5 and/or above.

#### 1.4.4. Pre-Warranty Conference

Prior to contract completion, or completion of any phase or portion of contract to be turned over, and at a time designated by the Contracting Officer, the Contractor shall meet with the Government to develop a mutual understanding with respect to the requirements of this clause. Communication procedures for Contractor notification of warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Government for the execution of the construction warranty shall be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor will furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, will be continuously

available, and will be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of his responsibilities in connection with other portions of this provision.

#### 1.4.5. Contractor's Response to Warranty Service Requirements.

Following Government oral or written notification, which may include authorized installation maintenance personnel, the Contractor shall respond to warranty service requirements in accordance with the "Warranty Service Priority List" and the three categories of priorities listed below. Submit a report on any warranty item that has been repaired during the warranty period. The report shall include the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframe specified, the Government will perform the work and backcharge the construction warranty payment item established.

1.4.5.1. First Priority Code 1 Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

1.4.5.2. Second Priority Code 2 Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

1.4.5.3. Third Priority Code 3 All other work to be initiated within 3 work days and work continuously to completion or relief.

1.4.5.4. The "Warranty Service Priority List" is as follows:

- Code 1 - Air Conditioning System
  - (a) Buildings with computer equipment.
  - (b) Barracks, mess halls (entire building down).
- Code 2 - Air Conditioning Systems
  - (a) Recreational support.
  - (b) Air conditioning leak in part of building, if causing damage.
  - (c) Air conditioning system not cooling properly
  - (d) Admin buildings with Automated Data Processing (ADP) equipment not on priority list.
- Code 1 - Doors
  - (a) Overhead doors not operational.
- Code 1 - Electrical
  - (a) Power failure (entire area or any building operational after 1600 hours).
  - (b) Traffic control devices.
  - (c) Security lights.
  - (d) Smoke detectors and fire alarm systems
  - (e) Power or lighting failure to an area, facility, portion of a facility, which may adversely impact health, safety, security, or the installation's mission requirement, or which may result in damage to property.
- Code 2 - Electrical
  - (a) Power failure (no power) for unoccupied buildings or portions thereof or branch circuits within occupied buildings, not listed as Code 1.
  - (a) Receptacle and lights, not listed as code 1.

- Code 3 - Electrical
  - (a) Street, parking area lights
- Code 1 - Gas
  - (a) Leaks and breaks.
  - (b) No gas to cantonment area.
- Code 1 - Heat
  - (a) Area power failure affecting heat.
  - (b) Heater in unit not working.
- Code 2 Heat
  - (a) All heating system failures not listed as Code 1.
- Code 3 - Interior
  - (a) Floor damage
  - (b) Paint chipping or peeling
- Code 1 - Intrusion Detection Systems - N/A.
- Code 2 - Intrusion Detection Systems other than those listed under Code 1
- Code 1 - Kitchen Equipment
  - (a) Dishwasher.
  - (b) All other equipment hampering preparation of a meal.
- Code 2 - Kitchen Equipment
  - (a) All other equipment not listed under Code 1.
- Code 2 - Plumbing
  - (a) Flush valves not operating properly
  - (b) Fixture drain, supply line commode, or water pipe leaking.
  - (c) Commode leaking at base.
- Code 3 - Plumbing
  - (a) Leaking faucets
- Code 1 - Refrigeration
  - (a) Mess Hall.
  - (b) Medical storage.
- Code 2 - Refrigeration
  - (a) Mess hall - other than walk-in refrigerators and freezers.
- Code 1 - Roof Leaks
  - (a) Temporary repairs will be made where major damage to property is occurring.
- Code 2 - Roof Leaks
  - (a) Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.
- Code 1 - Sprinkler System

- (a) All sprinkler systems, valves, manholes, deluge systems, and air systems to sprinklers.
  - Code 1 - Tank Wash Racks (Bird Baths)
- (a) All systems which prevent tank wash.
  - Code 1 - Water (Exterior)
- (a) Normal operation of water pump station.
  - Code 2 - Water (Exterior)
- (a) No water to facility.
  - Code 1 - Water, Hot (and Steam)
- (a) Barracks (entire building).
  - Code 2 - Water, Hot
- (a) No hot water in portion of building listed under Code 1

1.4.5.5. Should parts be required to complete the work and the parts are not immediately available, the Contractor shall have a maximum of 12 hours after arrival at the job site to provide the Government, with firm written proposals for emergency alternatives and temporary repairs for Government participation with the Contractor to provide emergency relief until the required parts are available on site for the Contractor to perform permanent warranty repair. The Contractor's proposals shall include a firm date and time that the required parts shall be available on site to complete the permanent warranty repair. The Government will evaluate the proposed alternatives and negotiate the alternative considered to be in the best interest of the Government to reduce the impact of the emergency condition. Alternatives considered by the Government will include the alternative for the Contractor to "Do Nothing" while waiting until the required parts are available to perform permanent warranty repair. Negotiating a proposal which will require Government participation and the expenditure of Government funds shall constitute a separate procurement action by the using service.

#### 1.4.6. Equipment Warranty Identification Tags

1.4.6.1. Provide warranty identification tags at the time of installation and prior to substantial completion shall provide warranty identification tags on all Contractor and Government furnished equipment which the Contractor has installed.

- (a) The tags shall be suitable for interior and exterior locations, resistant to solvents, abrasion, and to fading caused by sunlight, precipitation, etc. These tags shall have a permanent pressure-sensitive adhesive back, and they shall be installed in a position that is easily (or most easily) noticeable. Tag each component of contractor furnished equipment that has differing warranties on its components.
- (b) Submit sample tags, representing how the other tags will look, for Government review and approval.
- (c) Tags for Warranted Equipment: The tag for this equipment shall be similar to the following: Exact format and size will be as approved.

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EQUIPMENT WARRANTY - CONTRACTOR FURNISHED EQUIPMENT

MFG NAME

MODEL NO.

SERIAL NO.

CONTRACT NO.

CONTRACTOR NAME

CONTRACTOR WARRANTY EXPIRES

MFG WARRANTY(IES) EXPIRE

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EQUIPMENT WARRANTY - GOVERNMENT FURNISHED EQUIPMENT

MFG NAME

MODEL NO.

SERIAL NO.

CONTRACT NO.

DATE EQUIP PLACED IN SERVICE

MFG WARRANTY(IES) EXPIRE

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(d) If the manufacturer's name (MFG), model number and serial number are on the manufacturer's equipment data plate and this data plate is easily found and fully legible, this information need not be duplicated on the equipment warranty tag

1.4.6.2. Execution: Complete the required information on each tag and install these tags on the equipment by the time of and as a condition of final acceptance of the equipment.

## 1.5. MECHANICAL TESTING, ADJUSTING, BALANCING, AND COMMISSIONING

Submit; all reports, statements, certificates, and completed checklists for testing, adjusting, balancing, and commissioning of mechanical systems prior to final inspection and transfer of the completed facility for approval, as specified in applicable technical specification sections.

## 1.6. OPERATION AND MAINTENANCE MANUALS

### 1.6.1. General Requirements

1.6.1.1. Inasmuch as the operations and maintenance manuals are required to operate and maintain the facility, the operations and maintenance (O&M) manuals will be considered a requirement prior to substantial completion of any facility to be turned over to the Government. Beneficial occupancy of all or portions of a facility prior to substantial completion will not relieve the Contractor of liquidated damages, if substantial completion exceeds the required completion date.

1.6.1.2. Provide one permanent electronic copy on CD-ROM and 2 hard copies of the Equipment Operating, Maintenance, and Repair Manuals. Provide separate manuals for each utility system as defined hereinafter. Submit Operations and Maintenance manuals for approval before field training or 90 days before substantial completion (whichever occurs earlier). If there is no separate CLIN for O&M Manuals, the Government will withhold an amount representing \$20,000, as non-progressed work, until submittal and approval of all O&M manuals are complete.

### 1.6.2. Definitions

#### 1.6.2.1. Equipment

A single piece of equipment operating alone or in conjunction with other equipment to accomplish a system function.

#### 1.6.2.2. System

A combination of one or more pieces of equipment which function together to accomplish an intended purpose (i.e. HVAC system is composed of many individual pieces of equipment such as fans, motors, compressors, valves, sensors, relays, etc.)

### 1.6.3. Hard Cover Binders

The manuals shall be hard cover with posts, or 3-ring binders, so sheets may be easily substituted. Print the following identification on the cover: the words "EQUIPMENT OPERATING, MAINTENANCE, AND REPAIR MANUALS," the project name, building number, and an indication of utility or systems covered, the name of the Contractor, and the Contract number. Manuals shall be approximately 8-1/2 by 11-inches with large sheets folded in and capable of being easily pulled out for reference. All manuals for the project must be similar in appearance, and be of professional quality.

### 1.6.4. Warning Page



Provide a warning page to warn of potential dangers (if they exist, such as high voltage, toxic chemicals, flammable liquids, explosive materials, carcinogens, high pressures, etc.). Place the warning page inside the front cover and in front of the title page. Include any necessary Material Safety Data Sheets (MSDS) here.

#### 1.6.5. Title Page

The title page shall include the same information shown on the cover and show the name of the preparing firm and the date of publication.

#### 1.6.6. Table of Contents

Each volume of the set of manuals for this project shall include a table of contents, for the entire set, broken down by volume.

#### 1.6.7. GENERAL

Organize manuals according to the following format, and include information for each item of equipment. Submit a draft outline and table of contents for approval at 50% contract completion.

##### TABLE OF CONTENTS

##### PART I: Introduction

- Equipment Description
- Functional Description
- Installation Description

##### PART II: Operating Principles

##### PART III: Safety

##### PART IV: Preventive Maintenance

- Preventive Maintenance Checklist, Lubrication
- Charts and Diagrams

##### PART V: Spare Parts Lists

- Troubleshooting Guide
- Adjustments
- Common Repairs and Parts Replacement

##### PART VI: Illustrations

#### 1.6.7.1. Part I-Introduction

Part I shall provide an introduction, equipment or system description, functional description and theory of operation, and installation instructions for each piece of equipment. Include complete instructions for uncrating, assembly, connection to the power source and pre-operating lubrication in the installation instructions as applicable. Illustrations, including wiring and cabling diagrams, are required as appropriate in this section. Include halftone pictures of the equipment in the introduction and equipment description, as well as system layout drawings with each item of equipment located and marked. Do not use copies of previously submitted shop drawings in these manuals.

#### 1.6.7.2. Part II-Operating Principles

Part II shall provide complete instructions for operating the system, and each piece of equipment. Illustrations, halftone pictures, tables, charts, procedures, and diagrams are required when applicable. This will include step-by-step procedures for start-up and shutdown of both the system and each component piece of equipments, as well as adjustments required to obtain optimum equipment performance, and corrective actions for malfunctions. Show performance sheets and graphs showing capacity data, efficiencies, electrical characteristics, pressure drops, and flow rates here, also. Marked-up catalogs or catalog pages do not satisfy this requirement. Present performance information as concisely as possible with only data pertaining to equipment actually installed. Include actual test data collected for Contractor performance here.

#### 1.6.7.3. Part III-Safety

Part III shall contain the general and specific safety requirements peculiar to each item of equipment. Repeat safety information as notes cautions and warnings in other sections where appropriate to operations described.

#### 1.6.7.4. Part IV-Preventive Maintenance

Part IV shall contain a troubleshooting guide, including detailed instructions for all common adjustments and alignment procedures, including a detailed maintenance schedule. Also include a diagnostic chart showing symptoms and solutions to problems. Include test hookups to determine the cause, special tools and test equipment, and methods for returning the equipment to operating conditions. Information may be in chart form or in tabular format with appropriate headings. Include instructions for the removal, disassembly, repair, reassembly, and replacement of parts and assemblies where applicable and the task is not obvious.

#### 1.6.7.5. Part V-Spare Parts List

Part V shall contain a tabulation of description data and parts location illustrations for all mechanical and electrical parts. The heading of the parts list shall clearly identify the supplier, purchase order number, and equipment. Include the unit price for each part. List parts by major assemblies, and arrange the listing in columnar form. Include names and addresses of the nearest manufacturer's representatives, as well as any special warranty information. Provide a list of spare parts that are recommended to be kept in stock by the Government installation.

#### 1.6.7.6. Part VI-Illustrations

Part VI shall contain assembly drawings for the complete equipment or system and for all major components. Include complete wiring diagrams and schematics. Other illustrations, such as exploded views, block diagrams, and cutaway drawings, are required as appropriate.

#### 1.6.8. Framed Instructions

Post framed instructions are required for substantial completion. Post framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, including equipment, ductwork, piping valves, dampers, and control sequence at a location near the equipment described. Prepare condensed operating instructions explaining preventive maintenance procedures methods of checking the system for normal safe operation, valve schedule and procedures for safely starting and stopping the system in type form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. Submit proposed diagrams, instructions, and other sheets prior to posting. Post the framed instructions before field training.

#### 1.6.9. (Reserved. See 1.7 for Field Training)

#### 1.6.10. System/Equipment Requirements

#### 1.6.10.1. Facility Heating System

Provide information on the following equipment: boilers, water treatment, chemical feed pumps and tanks, converters, heat exchangers, pumps, unit heaters, fin-tube radiation, air handling units (both heating only and heating and cooling), and valves (associated with heating systems).

#### 1.6.10.2. Air-Conditioning Systems

Provide information in chillers, packaged air-conditioning equipment, towers, water treatment, chemical feed pumps and tanks, air-cooled condensers, pumps, compressors, air handling units, and valves (associated with air-conditioning systems).

#### 1.6.10.3. Temperature Control and HVAC Distribution Systems

Provide all information described for the following equipment: valves, fans, air handling units, pumps, boilers, converters and heat exchangers, chillers, water cooled condensers, cooling towers, and fin-tube radiation, control air compressors, control components (sensors, controllers, adapters and actuators), and flow measuring equipment.

#### 1.6.10.4. Central Heating Plants

Provide the information described for the following equipment: boilers, converters, heat exchangers, pumps, fans, steam traps, pollution control equipment, chemical feed equipment, control systems, fuel handling equipment, de-aerators, tanks (flash, expansion, return waters, etc.), water softeners, and valves.

#### 1.6.10.5. Heating Distribution Systems

Provide the information described for the following equipment: valves, fans, pumps, converters and heat exchangers, steam traps, tanks (expansion, flash, etc.), and piping systems.

#### 1.6.10.6. Exterior Electrical Systems

Provide information on the following equipment: power transformers, relays, reclosers, breakers, and capacitor bank controls.

#### 1.6.10.7. Interior Electrical Systems

Provide information on the following equipment: relays, motor control centers, switchgear, solid state circuit breakers, motor controller, EPS lighting systems, wiring diagrams and troubleshooting flow chart on control systems, and special grounding systems.

#### 1.6.10.8. Energy Monitoring and Control Systems

The maintenance manual shall include descriptions of maintenance for all equipment, including inspection, periodic preventative maintenance, fault diagnosis, and repair or replacement of defective components.

#### 1.6.10.9. Domestic Water Systems

Provide the identified information on the following equipment: tanks, unit process equipment, pumps, motors, control and monitoring instrumentation, laboratory test equipment, chemical feeders, valves, switching gear, and automatic controls.

#### 1.6.10.10. Wastewater Treatment Systems

Provide the identified information on the following equipment: tanks, unit process equipment, pumps, motors, control and monitoring instrumentations, laboratory test equipment chemical feeders, valves, scrapers, skimmers, comminutors, blowers, switching gear, and automatic controls.

#### 1.6.10.11. Fire Protection Systems

Provide information on the following equipment: alarm valves, manual valves, regulators, foam and gas storage tanks, piping materials, sprinkler heads, nozzles, pumps, and pump drivers.

#### 1.6.10.12. Fire Alarm and Detection Systems

- (1) The maintenance manual shall include description of maintenance for all equipment, including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
- (2) Provide all software; database with complete identification of programmable portions of system equipment and devices, and all other system programming data on all modes of the system; connecting cables; and proprietary equipment necessary for the operation, maintenance, testing, repair and programming, etc. of the system and that may be required for implementation of future changes to the fire system (additional and/or relocated initiating devices, notification devices, etc.
- (3) Provide all system and equipment technical data and computer software with the requisite rights to Government use, in accordance with the applicable contract clauses.
- (4) Training shall include software and programming required for the effective operation, maintenance, testing, diagnostics and expansion of the system.

#### 1.6.10.13. Plumbing Systems

Provide information on the following equipment: water heaters, valves, pressure regulators backflow preventors, piping materials, and plumbing fixtures.

#### 1.6.10.14. Liquid Fuels Systems

Provide information on the following equipment: tanks, automatic valves manual valves, filter separators, pumps, mechanical loading arms, nozzles, meters, electronic controls, electrical switch gear, and fluidic controls.

#### 1.6.10.15. Cathodic Protection Systems

Provide information on the following material and equipment: rectifiers, meters, anodes, anode backfill, anode lead wire, insulation material and wire size, automatic controls (if any), rheostats, switches, fuses and circuit breakers, type and size of rectifying elements, type of oil in oil-immersed rectifiers, and rating of shunts.

#### 1.6.10.16. Generator Installations

Provide information on the following equipment: generator sets, automatic transfer panels, governors, exciters, regulators starting systems, switchgear, and protective devices.

#### 1.6.10.17. Miscellaneous Systems

Provide information on the following: communication and ADP systems, security and intrusion alarm, elevators, material handling, active solar, photovoltaic, nurse call, paging, intercom, closed circuit TV, irrigation, sound and material delivery systems, kitchen, refrigeration, disposal, ice making equipment, and other similar type special systems not otherwise specified.

#### 1.6.10.18. Laboratory, Environmental and Pollution Control Systems

Provide information on the following equipment: wet scrubbers, quench chambers, scrub tanks, liquid oil separators, and fume hoods.

#### 1.7. FIELD TRAINING

Field Training is a requirement for substantial completion. Conduct a training course for the operating staff for each particular system. Conduct the training is to be conducted during hours of normal working time after the system is functionally complete. The field instructions shall cover all of the items contained in the Equipment Operating, Maintenance and Repair Manuals. The training will include both classroom and "hands-on" training. Submit a lesson plan outlining the information to be discussed during training periods. Submit this lesson plan for approval 90 days before contract completion before the field training occurs. Record training on DVD and furnish to the Government within ten (10) days following training. Document all training and furnish a list of all attendees.

#### 1.8. PRICING OF CONTRACTOR-FURNISHED AND INSTALLED PROPERTY AND GOVERNMENT-FURNISHED CONTRACTOR-INSTALLED PROPERTY

Promptly furnish and require any sub-contractor or supplier to furnish, in like manner, unit prices and descriptive data required by the Government for Property Record purposes of fixtures and equipment furnished and/or installed by the Contractor or sub-contractor, except prices do not need to be provided for Government-Furnished Property.

#### 1.9. LEED REVIEW MEETINGS

1.9.1. Pre-Closeout Meeting. Approximately 30 days before submittal of LEED closeout documentation, the Contractor and the Government's project delivery team (including Installation representative) will meet to review the documentation, determine which, if any, credits will be audited and identify any corrections/missing items prior to the closeout LEED documentation submittal.

1.9.2. Approximately 14 days after submittal of LEED closeout documentation, the Contractor and the Government's project delivery team (including Installation representative) will meet to review the LEED closeout documentation. The review conference will include discussion of and resolution of all review comments to ensure consensus on achievement of credits and satisfactory documentation. At the review conference a final score will be determined and endorsed in writing by all parties.

#### 1.10. RED ZONE MEETING

At approximately 80% of contract completion or 60 days before the anticipated Beneficial Occupancy Date (BOD), whichever occurs first, the Contractor and the Government's project delivery team will conduct what is known as the Red Zone Meeting to discuss the close-out process, to schedule the events and review responsibilities for actions necessary to produce a timely physical, as well as fiscal, project close-out. The Red Zone meeting derives its name from the football term used to describe the team effort to move the ball the last 20 yards into the end zone. The close-out of a construction project sometimes can be equally as hard and most definitely requires the whole team's efforts. The ACO will chair the meeting. If not already provided, shortly before the meeting, the Contractor shall provide an electronic copy or access to the CADD as-built drawings, completed commensurate with the amount of work completed at the time of the Red Zone Meeting, as an indicator of the Contractors' understanding of and ability to meet the USACE CADD Standards and to ensure that the Contractor is making progress with CADD As-Built requirements. EXHIBIT 1 is a generic meeting checklist.

#### 1.11. FINAL CLEANING

Clean the premises in accordance with FAR clause 52.236-12 and additional requirements stated here. Remove stains, foreign substances, and temporary labels from surfaces. Vacuum carpet and soft surfaces. Clean equipment and fixtures to a sanitary condition. Clean or replace filters of operating equipment if cleaning isn't possible or practicable. Remove debris from roofs, drainage systems, gutters, and downspouts. Sweep paved areas and rake clean landscaped areas. Remove waste, surplus materials, and rubbish from the site. Remove all temporary structures, barricades, project signs, fences and construction facilities. Submit a list of completed clean-up items on the day of final inspection.

#### 1.12. INTERIM FORM DD1354 "TRANSFER AND ACCEPTANCE OF MILITARY REAL PROPERTY

Near the completion of Project, but a minimum of 60 days prior to final acceptance of the work, complete, update draft provided with the final design package(s) (see Section 01 33 16, paragraph 3.7.5) and submit an accounting of all installed property on Interim Form DD1354 "Transfer and Acceptance of Military Real Property." Include any additional assets/improvements/alterations and cost updates from the Draft DD Form 1354. Contact the COR for any project specific information necessary to complete the DD Form 1354. This form will be a topic for the Red Zone Meeting discussed above. For information purposes, a blank DD Form 1354 (fill-able) in ADOBE (PDF) may be obtained at the following web site: <http://www.dtic.mil/whs/directives/infomgt/forms/eforms/dd1354.pdf> Submit the completed Checklist for Form DD1354 of Government-Furnished and Contractor-Furnished/Contractor Installed items. Attach this list to the updated DD Form 1354. Instructions for completing the form may be obtained through the US Army Corps of Engineers TECHINFO Website at <http://www.hnd.usace.army.mil/techinfo/> under publications, in Unified Facilities Criteria UFC 1-300-08.

## EXHIBIT 1

**SAMPLE**

## Red Zone Meeting Checklist

Date: \_\_\_\_\_

<b>Contract No.</b>		
<b>Description / Location</b>		
<b>Contractor</b>		
<b>Contracting Officer</b>		
<b>Action</b>	<b>Completion Milestone</b>	<b>√</b>
Inspections		
Fire		
Safety		
Pre-final		
Mechanical Test & Balance		
Commissioning		
Landscaping Complete		
Erosion Control		
Beneficial Occupancy Date (BOD)		
Furniture Installation		
Comm Installation		
As-Built Drawings		
Provide all O&M manuals, tools, shop drawings, spare parts, etc. to customer		
Training of O&M Personnel		
Provide Warranty documents to Customer		
Contract completion		
Final Inspection		

User move-in		
DD Form 1354, Transfer of Real Property completed & signed		
Ribbon cutting		
Payroll Clearances		
DD Form 2626 - Construction Contractor Performance Evaluation		
DD Form 2631 – A-E Performance Rated after Construction		
Status of Pending Mods and REA's/Claims		
Final Payment Completed		
Release of Claims		
Return of Unobligated Funds		
Move Project from CIP to General Ledger		
Financial completion		

End of Section 01 78 02.00 10



## APPENDIX A - GEOTECHNICAL REPORT AND REQUIREMENTS

### FIRE STATION – FORT BELVOIR, VA

#### I. Project Location and General Requirements

- A. Project Location and General Scope: The project site is located on the South Post of Ft. Belvoir, VA on the Northeast corner of the intersection of Gunston Road and 16<sup>th</sup> Street. The project entails the construction of a Fire Station Building with supporting infrastructure such as pavements and utilities.
- B. Intent of Geotechnical Data/Recommendations: The geotechnical data included in this report is preliminary. It is intended to provide the Request for Proposal (RFP) bidders with sufficient information to identify the general subsurface conditions of the site. The selected Contractor's geotechnical engineer shall perform a site specific geotechnical exploration and testing program to accurately characterize the site and shall perform the final design for all geotechnical features of work. The Contractor is fully responsible for acceptable foundations, pavements and other geotechnical aspects of the proposed project. The additional investigation, identification of subsurface materials and laboratory testing shall be in accordance with applicable ASTM standards and good geotechnical practice. Soil classifications shall be in accordance with ASTM D 2487 Classification of Soils for Engineering Purposes and ASTM D 2488 Description and Identification of Soils (Visual-Manual Procedure).
- C. Design Analysis: Submit design analyses with calculations for the foundation and pavement designs. The calculations shall be legible, orderly and easily understandable. All assumptions and references to codes, standards, criteria, drawings, and computer output shall be noted as necessary. Submission shall also include subsurface information (in the form of boring logs and lab test data) upon which the designs are based. Submissions shall also be in accordance with requirements provided in other sections of this RFP package.
- D. Specifications: Submit new specification sections in accordance with requirements listed in the RFP package, to specify the quality, characteristics, construction and installation procedures, testing, and certification requirements for all items of the proposed foundation systems, pavements, and earthwork. Specifications shall also be in accordance with requirements provided in other sections of this RFP package.

#### II. Subsurface Conditions

- A. Regional Geology: Ft. Belvoir is located within the Atlantic Coastal Plain Physiographic Province approximately three miles east of the "Fall Line". The "Fall Line" represents the boundary separating the Coastal Plain from the Piedmont Physiographic province. The Coastal Plain is a wedge of sedimentary deposits which gradually thickens to the southeast and overlies the crystalline bedrock of the Piedmont.

Locally, the overburden soils consist of Pleistocene Terrace deposits overlying marine deposits of the Potomac Group.

- B. Subsurface Exploration: A subsurface investigation program was performed at the project site in November 2008. The investigation consisted of 5 borings (DH-1 to DH-5) performed in vicinity of the planned building site. Two additional borings (DH-6 & DH-7) were performed in what was originally planned as a stormwater utility area (this area was later removed from the project extents). The boring location plan and boring logs are appended to this report. The borings were advanced by means of the Standard Penetration Test procedure (SPT). The SPT procedure advances a 1-3/8" interior diameter by 2'-8" long split spoon sampler using a 140 lb hammer falling 30". The number of blows required to advance the sample spoon in intervals of 6" (for a total 1.5' length sample) were recorded on the logs with the sum of the latter two blow counts being referred to as the "N" value. Disturbed samples were obtained at 2.5' intervals with the holes being power augered between samples.
- C. Availability of Subsurface Samples: Samples obtained from the drilling program (except those used up during the lab testing) are available for inspection by all RFP offerers. These samples are available at the offices of the Baltimore District Corps of Engineers. Prospective bidders are required to call 410-962-4045 a minimum of 24 hours in advance to arrange a time and date for inspection of the samples. Calls must be made between the hours of 9:00 a.m. and 3:30 p.m. Monday through Friday (excluding federal holidays)
- D. Laboratory Testing: All soil samples obtained from the subsurface exploration program were visually classified in the laboratory based on the Unified Soils Classification System, Visual/Manual procedure (USCS, ASTM D 2488). Additional soils testing including mechanical analyses with hydrometer, Atterberg limit determinations, and natural water content determinations was also performed on representative samples.
- E. General Stratigraphy:
- 1) *Building Site East of Gunston Road*: Existing structures (some requiring demolition), and existing surficial fills and backfills associated with such structures, utilities, etc will be encountered and will vary in depth and composition across the area. Below these surficial "fill" materials from past construction, conditions are primarily characterized by silty and clayey sands (SC & SM) with zones of clays and silts (CL & ML).
  - 2) *West of Gunston Road*: As previously indicated, stormwater utilities were originally planned to be constructed in the area of DH-6 & 7. This area was later removed from the project extents due to poor conditions encountered and will not impact the work to be performed. Documentation of conditions in that area is only included herein to fully describe the original drilling program. Significant depths of uncontrolled fill material exist in the area. These fill materials extend to 25 feet in DH-6 and 17 feet in DH-7 and contain soil intermixed with a variety of trash and

debris such as large pieces of wood and pieces of coal. The fill materials are also very soft as evidenced by the low blow counts shown in the logs. Silty and clayey sands underlie these fill materials.

- F. Groundwater: Where encountered, groundwater was between 25' and 30' below top of hole elevations. Groundwater levels should be anticipated to fluctuate with changes in seasons and precipitation levels..

### III. Earthwork

- A. Drainage and Water Control: Proper drainage and collection provisions should be employed to minimize exposure of the site soils to moisture and to prevent surface runoff from entering excavations. Appropriate measures shall be employed as necessary to maintain dewatered excavations.
- B. Fill, Backfill and Subgrade Moisture Control and Compaction: Materials used for filling and backfilling shall be specified by the geotechnical designer as appropriate for the application. The maximum particle size shall be limited to 3 inches in diameter. Appropriate compaction requirements shall also be specified. Unless otherwise required to achieve certain engineering properties, the following criteria shall be used:
- Materials for backfill below and around structures and pavements shall be compacted to a minimum 90 percent of laboratory maximum density (ASTM D 1557, Procedure C) for cohesive soils and to 95 percent of laboratory maximum density for cohesionless soils. Compaction shall be at moisture contents within plus or minus 2% of optimum. Materials shall be placed in loose lifts not exceeding 8" except that the lift thickness shall be limited to 6" where hand operated compaction equipment is used.
  - Materials in future grassed areas where no specific strengths are required shall be compacted to a minimum of 85 percent of laboratory maximum density (ASTM D 1557, Procedure C) for cohesive soils and to 90 percent of laboratory maximum density for cohesionless soils. Compaction may be at moisture contents which facilitate such densities. Materials shall be placed in loose lifts not exceeding 12".
  - It should be anticipated that insitu soils have high insitu moisture contents which will require significant drying prior to use for any on-site earthwork activities.
- C. Excavation: Excavations shall be shored or sloped as appropriate to ensure worker safety and to ensure that adjacent structures, utilities and other existing features are not adversely affected.

#### IV. Pavements

- A. Criteria: Pavements shall be designed in accordance with either the USACE Pavement Transportation Computer Assisted Structural Engineering (PCASE) program or the AASHTO Guide for Design of Pavement Structures. The PCASE program is available from [www.PCASE.com](http://www.PCASE.com). Regardless of the method used, in no case should the pavement section thickness be less than the minimums stated herein. All other requirements presented herein for items such as material type and placement shall be followed.
- B. Traffic: Pavements must be designed for appropriate vehicle types and frequencies to which they will be subjected over their design life. The contractor's designer is responsible for determining the specific traffic requirements. It should, however, be understood that pavements will need to be designed to withstand heavily loaded fire trucks/ladder trucks.
- C. Minimum Pavement Thicknesses: In no case shall the pavement sections be less than the required minimums below:
1. *Bituminous Pavement Subject to Truck or Fire Truck Traffic*: Bituminous pavements having Fire Truck or other large truck traffic shall have a minimum of 4" of Hot Mix Asphalt over a minimum of 15" of aggregate base.
  2. *Bituminous Parking Lots (passenger vehicle traffic only)*: Bituminous pavements having passenger vehicle traffic only shall have a minimum of 2" of Hot Mix Asphalt over a minimum of 12" of aggregate base.
  3. *Exterior Concrete Pavement*: Exterior concrete pavements shall have a minimum of 8" of concrete over a minimum of 8" of aggregate base.
  4. *Interior Concrete Pavement*: Interior concrete pavements shall have a minimum 8" thick concrete slab. Materials below the slab shall consist of a minimum 4" thickness of capillary water barrier (ASTM C33, #57 stone) placed on the soil subgrade; overlain by a minimum 10 mil polyethylene sheeting vapor barrier; overlain by a minimum 4" layer of "trimmable, compactable, granular fill" as discussed in ACI 302.1R. The capillary water barrier shall be choked off with sand prior to placement of the vapor barrier to prevent puncture. The trimmable, compactable fill shall be constructed only after the roof is in place to prevent intrusion of water as discussed in ACI 302.1R.
- D. Concrete Materials, Doweling, Reinforcing: Concrete pavement shall have a minimum flexural strength of 650 psi at 28 days. Joints in concrete pavements shall be doweled. Reinforcement shall be used as required by criteria based upon factors such as panel dimensions and shape.

- E. Asphalt Materials: Asphalt pavements shall use appropriately designed Superpave Mix(es) meeting all requirements of the most recent Virginia Department of Transportation Road and Bridge Specifications..
- F. Aggregate Base Course: Aggregate base for the pavements requires the use of two different material types – 1) A dense graded aggregate to provide high strength and to limit intrusion of underlying subgrade soil fines and 2) A drainage aggregate to facilitate water movement to subdrains and thereby limit frost impacts on the pavement. For asphalt pavements the total aggregate base thickness shall be divided into 3 equal thickness layers. The middle layer shall consist of drainage aggregate and the upper and lower layers shall consist of dense graded aggregate. For exterior concrete pavements, the total aggregate base thickness shall be divided into 2 equal thickness layers. The upper layer shall consist of drainage aggregate and the lower layer shall consist of dense graded aggregate.

Dense Graded Aggregate: Dense Graded Aggregate shall meet the requirements of “21A” as defined in Table II-9 of Section 208 of the 2007 Virginia Department of Transportation Road and Bridge Specifications. Recycled concrete materials are not allowed for use as aggregate base course on the project.

**Drainage Aggregate:** The Drainage Aggregate materials should meet the one of the three gradations below. Recycled concrete materials are not allowed for use as aggregate base course on the project.

The drainage aggregates shall have a 2-inch maximum size and shall be continuously graded within the following limits:

Sieve Designation	Percentage by Weight Passing Designated Square-Mesh Sieve		
	No. 1	No. 2	No. 3
2-inch	100	100	----
1-1/2 inch	100	---	100
1-inch	95-100	---	96-100
3/4-inch	82-92	52-100	70-83
1/2-inch	62-80	---	44-70
3/8-inch	59-73	36-65	38-59
No. 4	40-55	8-40	24-33
No. 8	5-25	---	20-29
No. 16	0-5	0-12	12-21
No. 50	0-2	---	2-8
No. 100	----	---	0-3
No. 200	----	0-5	----

A 50% - 50% blend of No. 57 and No. 9 coarse aggregate (ASTM D 448) will fall within the above gradation band No. 1. A 75% - 25% blend of No. 57 coarse aggregate and concrete fine aggregate (ASTM D 448) will fall within gradation band No. 3. The materials shall be blended at the source prior to shipping to the project site.

- G. Subsurface Drainage: A pavement subdrainage system is required to limit frost impacts on the pavements. This system shall consist of a series of perforated pipe subdrains used in combination with the drainage aggregate within the pavement base course as previously discussed. The subdrains shall be placed along the edges of roadways and at 50 ft to 75 ft intervals within large paved areas so as to effectively drain the pavement base course. The subdrains shall consist of a 6-inch minimum diameter perforated pipe surrounded by a minimum of 3 inches of ASTM C33, #57 crushed stone on the bottom, 6 inches (minimum) on each side, and sufficient crushed stone above the top of the pipe to extend to the Rapid Drainage Material layer within the base course. The crushed stone filter material will be completely enveloped in a filter fabric meeting the requirements of AASHTO M-288-96, Class 2. Subdrains should outlet into the storm drainage system or should outlet onto the ground surface. Drains which outlet the water to the ground surface must utilize an appropriate concrete "headwall" and must be provided with rodent screens. An example subdrain detail is attached to this report.

## **V. Foundation Requirements**

The site specific geotechnical investigation and foundation design shall be performed by the selected Contractor's geotechnical engineer in accordance with good geotechnical practice. The geotechnical engineer shall be a registered professional engineer, specializing in geotechnical consultation and having experience in the project's geographical region. The foundation design shall consider shear failure criteria, settlement criteria, fill induced settlements and all other relevant factors. Substantiating calculations shall be included with the project design submissions.

For bidding purposes, it should be assumed that a shallow foundation system of spread and strip footings will support the building. It should be assumed that the presence of surficial fill materials from past development will require lowering of foundations below such materials or replacement of such materials with engineered fill. It should be assumed that the involvement of the geotechnical designer during construction will be required for related foundation subgrade inspections. Specific foundation requirements will depend, in large part, upon the details of the contractor's building design, loads, grading, and similar factors. Final foundation requirements shall be determined by the contractor's geotechnical designer.





0 25 50 100 150 200 Feet

**FIRE STATION  
FT. BELVOIR, VA.  
BORING PLAN**



**FIRE STATION  
FT. BELVOIR, VA.**

**SUBSURFACE EXPLORATION NOTES**

1. EXPLORATION WAS PERFORMED DURING NOVEMBER 2008.
2. DRILL HOLES (DH) WERE ACCOMPLISHED BY STANDARD PENETRATION TEST PROCEDURE (SPT, ASTM - 1586) USING A 1 3/8" ID SPLIT SPOON SAMPLER. SAMPLE SPOONS WERE ADVANCED BY A 140# HAMMER FALLING 30". THESE HOLES WERE POWER AUGERED BETWEEN SAMPLES UNLESS OTHERWISE INDICATED. BLOW COUNTS SHOWN ARE FOR 0.5' OF DRIVE, UNLESS OTHERWISE INDICATED.
3. BLOW COUNTS REQUIRED TO ADVANCE SAMPLE SPOON ARE SHOWN IN COLUMN (a).  
  
WOH - DENOTES WEIGHT OF HAMMER
4. COLUMN (b) SHOWS THE NATURAL WATER CONTENTS IN PERCENT OF DRY WEIGHT OF THOSE SAMPLES TESTED.
5. SOIL DESCRIPTIONS ARE SHOWN IN COLUMN (c).  
  
ALSO SHOWN IN THIS COLUMN ARE:  
  
PPR - UNCONFINED COMPRESSION STRENGTH (tsf) READINGS FROM POCKET PENETROMETER TESTS. NOTHING IS SHOWN IF THE ENTIRE SAMPLE IS NOT SUITABLE FOR PPR TESTS.
6. SOIL DESCRIPTIONS ARE LABORATORY CLASSIFICATIONS BASED ON THE UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2487/2488), EXCEPT THOSE INDICATED THUS (\*\*), WHICH ARE FIELD INSPECTOR'S CLASSIFICATIONS.
7. GROUNDWATER DEPTHS ARE INDICATED ON THE LOGS AS ▽, ▼ & ▼ ARE SHOWN IN COLUMN (d). PERTINENT DATA FOR THESE READINGS ARE SHOWN AT THE BOTTOM OF LOG UNDER GROUNDWATER DATA OR ADDITIONAL GROUNDWATER DATA. THESE READINGS MAY VARY DEPENDING UPON SEASONS AND AMOUNT OF RAINFALL.  
  
NE - INDICATES GROUNDWATER READING NOT ENCOUNTERED.  
NT - INDICATES GROUNDWATER READING NOT TAKEN.
8. ELEVATIONS SHOWN ON THE BORING LOGS ARE GROUND SURFACE ELEVATIONS AT THE TIME OF EXPLORATION. THEY WERE DETERMINED BY SURVEY.
9. FOR LOCATIONS OF SUBSURFACE EXPLORATIONS, SEE BORING LOCATION PLAN.

STA.  
OFFSET:  
TOP ELEV: 137.9

FIRE STATION  
FT. BELVOIR, VA.

N 6938274.8  
E 11870434.7  
COMPLETED: November 17, 2008

DH-1

1 of 1

Depth(ft)	(c)	(d)	(a)	(b)
	Moist, yellow brown, silty, fine SAND w/tr. of gravel (SM)		3-4-4	
2.0				
	Moist, strong brown, clayey, fine SAND w/tr. of gravel (SC) PPR 2.5'-4.0': 3.0, 2.75, 4.0		4-9-12	12.3
4.5				
	Moist, strong brown, clayey, med SAND w/gravel (SC)		5	7.3
			13-16-19	
			8-13-35	
12.0			10	
			9-25-31	
13.0	Moist, strong brown, silty, med SAND w/gravel (SM)			
	Moist, strong brown, silty, med SAND w/tr. of gravel (SM)		14-10-8	
15.7			15	
17.0	Moist, yellow brown, silty, fine to med SAND (SM)		5-7-9	
	Moist, strong brown, silty, fine SAND (SM)		5-5-8	
20.5			20	
	Moist, yellow brown, silty, med SAND w/gravel (SM/GM)		13-28-29	
22.0				
	Moist, yellow brown, silty, med SAND w/gravel (SM)		13-28-42	
24.5			25	
	Moist, yellow brown, silty GRAVEL w/sand (GM)		23-24-24	
29.0			34-29-28	
	BOTTOM OF HOLE		30	

DH-1

## GROUNDWATER DATA

WHILE DRILLING: NE

ON COMPLETION: NE

24 Hr. READING: NE



Fill



Auger



SPT



RB



Cored



300 lb



Tubex



Hand



Fish Tail



Vibra Core



Water Jet



Odex

Information Only - Subject to Revision

Tuesday, January 17, 2012

STA.  
OFFSET:  
TOP ELEV: 141.4

FIRE STATION  
FT. BELVOIR, VA.

N 6938342.5  
E 11870545.8  
COMPLETED: November 17, 2008

DH-2

1 of 1

Depth(ft)	(c)	(d)	(a)	(b)
0.2	Dry, black w/gray, hard, asphalt parking lot surface (**)		3-3-3	
2.0	Moist, dk. yellow brown, clayey, med SAND w/gravel (SC) PPR 0.2'-1.5': 3.0, 2.0, 2.5			
4.5	Moist, dk. yellow brown, fine, sandy, clayey SILT (ML/CL) PPR 2.5'-4.0': 3.0, 2.0, 2.5		2-2-2	14.0
	Moist, yellow red, clayey, med SAND w/gravel (SC)	5	2-6-13	13.0
9.5			11-16-19	
	Moist, strong brown, silty, med SAND w/gravel (SM)	10	20-23-26	
14.5			10-13-13	
	Moist, yellow brown, silty, fine to med SAND w/gravel (SM)	15	6-6-9	
19.5			6-8-6	
22.0	Moist, strong brown, silty, fine to med SAND w/tr. of gravel (SM)	20	6-9-11	
24.5	Moist, strong brown, silty, med SAND w/gravel (SM)		17-29-15	
27.0	Moist, yellow brown, silty, med SAND w/gravel (SM)	25	10-39-42	
29.0	Moist, strong brown, clayey, fine SAND w/gravel (SC)		29-50/0.4-50/0.25	
	BOTTOM OF HOLE	30		
	Note: Hole was backfilled and asphalt surface was repaired on 18 Nov. 2008.			

DH-2

GROUNDWATER DATA

WHILE DRILLING: NE

ON COMPLETION: NE

24 Hr. READING: NE



Fill



Auger



SPT



RB



Cored



300 lb



Tubex



Hand



Fish Tail



Vibra Core



Water Jet



Odex

Information Only - Subject to Revision

Tuesday, January 17, 2012

STA.  
OFFSET:  
TOP ELEV: 139.9

FIRE STATION  
FT. BELVOIR, VA.

N 6938247.4  
E 11870511.8

### DH-3













**1 of 1**

COMPLETED: November 17, 2008

	(c)	(d)	(a)	(b)
0.4	Black & gray, hard, asphalt parking lot surface (**)		9-7-5	
2.0	Moist, yellow brown, clayey, med SAND w/gravel (SC)			
	Moist, yellow brown, silty LEAN CLAY w/sand (CL) PPR 2.5'-4.0': 2.2, 3.0, 3.25		3-4-6	19.6
4.5				
	Moist, yellow red & yellow brown, clayey SAND w/tr. of gravel (SC) PPR 5.0'-6.5': 4.0, 4.25, 3.75	5	5-9-11	14.8
7.0				
	Moist, strong brown, clayey, med to coarse SAND w/gravel (SC)		20-31-44	
9.5				
	Moist, strong brown, silty, med to coarse SAND w/gravel (SM)	10	12-23-26	
			16-16-16	
14.5				
	Moist, strong brown, silty, med to coarse SAND w/tr. of gravel (SM)	15	10-10-10	
			4-5-8	
19.5				
	Moist, strong brown, silty, med to coarse SAND w/tr. of gravel & clay (SM)	20	5-7-12	
22.0				
	Moist, yellow brown, silty GRAVEL w/sand (GM)		23-50/0.2-50/0.5	
24.5				
	Moist, yellow brown, silty, med SAND w/tr. of gravel & clay (SM)	25	4-19-23	
27.0		▼ ▽ ▼		
	Moist, yellow brown, silty GRAVEL w/sand (GM)		15-32-48	
29.0				
	BOTTOM OF HOLE			
	Note: Hole was backfilled and asphalt surface was repaired on 18 Nov. 2008.			

DH-3  
GROUNDWATER DATA

▽ WHILE DRILLING:	27.5
▽ ON COMPLETION:	28.63
▽ 24 Hr. READING:	26.61

 Fill	 Auger	 SPT	 RB
 Cored	 300 lb	 Tubex	 Hand
 Fish Tail	 Vibra Core	 Water Jet	 Odex

Information Only - Subject to Revision

Tuesday, January 17, 2012

GEO-2 FIRE STATION.GPJ 1/9/09 13:07

STA.  
OFFSET:  
TOP ELEV: 138.5

FIRE STATION  
FT. BELVOIR, VA.

N 6938174.7  
E 11870464.9

# DH-4

**1 of 1**

COMPLETED: November 17, 2008

Depth(ft)	(c)	(d)	(a)	(b)
0.4	Moist, dk. yellow brown, silty, fine sandy, LEAN CLAY w/tr. of gravel, grass & roots (CL)		3-4-4	
2.0	Moist, yellow brown, silty, fine sandy, LEAN CLAY w/tr. of gravel (CL)			
4.5	Moist, strong brown, clayey, med SAND w/gravel (SC)		9-10-13	6.4
7.0	Moist, yellow red, clayey, silty, med SAND w/gravel (SM/SC)	5	13-20-25	9.1
9.5	Moist, strong brown, clayey, silty, med SAND w/gravel (SM)		13-15-19	
17.0	Moist, strong brown, silty, med SAND w/gravel (SM)	10	11-16-19	
18.0	Moist, strong brown, silty, med SAND (SM)		11-12-13	
19.5	Moist, strong brown, poorly graded SAND w/silt (SP-SM)	15	7-8-8	
22.0	Moist, strong to dk. yellow brown, silty, med SAND (SM)		4-4-5	
23.0	Moist, strong brown, clayey, silty, med SAND w/gravel (SM)	20	8-8-8	
24.5	Moist, pale brown, silty, fine to med SAND (SM)		6-5-3	
27.0	Moist, yellow brown, poorly graded SAND w/silt & gravel (SP-SM)	25	37-33-28	
29.0	Moist, yellow brown, clayey, med SAND w/gravel (SC)		14-18-19	
BOTTOM OF HOLE				
Note: 24 hour groundwater reading not possible due to hole collapse.				

DH-4

## GROUNDWATER DATA

∇ WHILE DRILLING: 27.5

**ON COMPLETION: 27.11**

24 Hr. READING: NT



## Fill



## Auger



**SPT**



RB



**Cored**



**300 lb**



## Tubex



## Hand

**Vibra**

## Vibra Core



## Water Jet



## Odex

STA.  
OFFSET:  
TOP ELEV: 141.1

FIRE STATION  
FT. BELVOIR, VA.

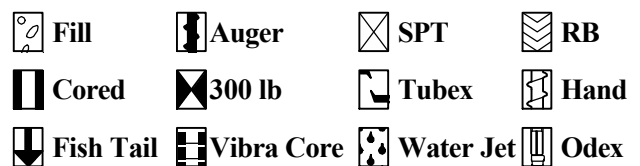
N 6938208.6  
E 11870566.1  
COMPLETED: November 18, 2008

**DH-5****1 of 1**

Depth(ft)	(c)	(d)	(a)	(b)
0.4	Dry, black & gray, hard, asphalt parking lot surface (**)		2-2-2	
2.0	Moist, dk. yellow brown, clayey, med SAND w/gravel (SC)			
	Moist, yellow brown, clayey, fine to med SAND (SC)		3-6-15	15.0
4.5				
	Moist, yellow red & brown, silty, fine to med SAND w/gravel (SM-H)	5	12-14-15	18.7
7.0				
	Moist, yellow red, clayey, med SAND w/tr.of gravel (SC)		11-15-18	12.3
9.5				
	Moist, yellow red & brown, clayey, med SAND w/gravel (SC)	10	17-25-21	
12.0				
	Moist, strong brown, silty, med SAND w/tr. of gravel (SM)		13-13-15	
14.5				
	Moist, strong brown, poorly graded SAND w/silt & gravel (SP-SM)	15	11-15-17	
			6-6-8	
		20	5-5-5	
			12-12-25	
24.5				
	Moist, strong brown, silty, med SAND w/gravel (SM)	25	17-15-19	
27.0				
	Moist, strong brown, silty, GRAVEL w/sand (GM/SM) w/pulverized gravel		48-34-32	
29.0				
	BOTTOM OF HOLE			
	Note: Hole was backfilled and asphalt surface was repaired on 19 Nov. 2008.	30		

DH-5  
GROUNDWATER DATA

WHILE DRILLING: NE  
ON COMPLETION: NE  
24 Hr. READING: NE



STA.  
OFFSET:  
TOP ELEV: 125.1

FIRE STATION  
FT. BELVOIR, VA.

N 6938290.3  
E 11869730.4  
COMPLETED: November 18, 2008

**DH-6****1 of 1**

Depth(ft)	(c)	(d)	(a)	(b)
0.3	Moist, dk. gray, fine sandy, silty LEAN CLAY w/tr. of gravel & grass roots (CL/ML) {FILL}		3-4-5	
2.0	Moist, gray, sandy LEAN CLAY w/gravel (CL) {FILL}			
4.5	Moist, dk. yellow brown, clayey, med SAND w/gravel & tr. of brick frags. (SC) {FILL}		5-5-6	
	PPR 2.0'-4.5': 3.5, 3.5, 4.0			
	Moist, strong brown, sandy LEAN CLAY w/gravel (CL) {FILL}	5	7-6-4	
7.0	Moist, strong brown, sandy LEAN CLAY w/tr. of gravel (CL) {FILL}			
9.5	Moist, strong brown, sandy LEAN CLAY w/gravel (CL) {FILL}		3-3-3	13.6
12.0	Moist, strong brown, sandy LEAN CLAY w/gravel (CL) {FILL}	10	3-3-3	14.5
	PPR 10.0'-11.5': 1.0, 1.5, 1.0			
14.5	Moist, gray & yellow brown, soft, LEAN CLAY w/sand (CL) {FILL}		2-2-2	25.0
	PPR 12.5'-14.0': 1.5, 1.5, 2.0			
19.5	Moist, gray & yellow brown, soft, LEAN CLAY w/sand & tr. of gravel (CL) {FILL}	15	1-2-2	20.8
	PPR 15.0'-16.5': 0.75, 0.5, 0.5			
	PPR 17.5'-19.0': 0.25, 0.5, 0.25			
			WOH-WOH-WOH	21.8
24.5	Moist, gray & yellow brown, soft, LEAN CLAY w/sand, tr. of gravel & large amount of coal fragments (CL) {FILL}	20	1-2-2	
	PPR 20.0'-21.5': 1.5, 0.5, 1.0			
27.0	Moist, strong brown, clayey, med SAND (SC)	25	2-2-3	
28.0	Very moist, yellow brown, clayey, silty, med SAND (SC/SM)			
29.0	Moist, yellow brown, silty, clayey, med SAND (SC)		6-7-6	
	BOTTOM OF HOLE			
	Note: 24 hour groundwater reading not possible due to hole collapse.			

**DH-6  
GROUNDWATER DATA**

▽ WHILE DRILLING: 27.5

▼ ON COMPLETION: 28.81

24 Hr. READING: NT



Fill



Auger



SPT



RB



Cored



300 lb



Tubex



Hand



Fish Tail



Vibra Core



Water Jet



Odex

STA.  
OFFSET:  
TOP ELEV: 125.4

FIRE STATION  
FT. BELVOIR, VA.

N 6938183.9  
E 11869786.8  
COMPLETED: November 18, 2008

DH-7

1 of 1

Depth(ft)	(c)	(d)	(a)	(b)
0.4	Moist, dk. yellow brown, sandy, LEAN CLAY w/tr of gravel & grass roots (CL) {FILL}		3-3-3	
2.0	Moist, strong brown, sandy LEAN CLAY w/tr. of gravel (CL) {FILL} PPR 0.4'-2.0': 3.5, 3.5, 3.5			
4.5	Moist, dk. grayish brown, sandy LEAN CLAY w/gravel (CL) {FILL} PPR 2.5'-4.0': 4.0, 4.0, 3.75		6-11-6	
7.0	Moist, strong brown & gray, sandy, firm LEAN CLAY w/tr. of gravel (CL) {FILL} PPR 5.0'-6.5': 1.5, 1.0, 1.5		2-2-2	19.4
9.5	No Recovery		1-1-1	
12.0	Moist, strong brown & gray, soft LEAN CLAY w/large piece of wood (CL) {FILL} PPR 10.0'-11.5': 0.5, 0.5, 0.75		20-5-3	26.3
14.5	No Recovery		1-1-2	
17.0	Moist, strong brown, clayey, silty, med SAND w/gravel & large piece of wood (SM) {FILL}		8-8-8	12.2
19.5	Moist, strong brown, clayey, med SAND w/gravel (SC)		19-15-12	13.4
22.0	Moist, strong brown & gray, silty SAND w/tr. pulverized gravel (SM)		50/0.1-50/0.05	14.6
24.5	Moist, pale brown, clayey, fine SAND (SC) PPR 22.5'-24.0': 3.0, 3.25, 2.0		6-8-10	
27.0	Moist, brownish yellow, clayey, silty, med SAND (SM)		7-7-9	
29.0	Moist, yellow brown, clayey, silty, med SAND (SM) {strong fuel odor}		7-7-11	
	BOTTOM OF HOLE			
	Note: 24 hour groundwater reading not possible due to hole collapse.			

DH-7  
GROUNDWATER DATA

▽ WHILE DRILLING: 27.5

▼ ON COMPLETION: 27.26

24 Hr. READING: NT



Fill



Auger



SPT



RB



Cored



300 lb



Tubex



Hand



Fish Tail



Vibra Core



Water Jet



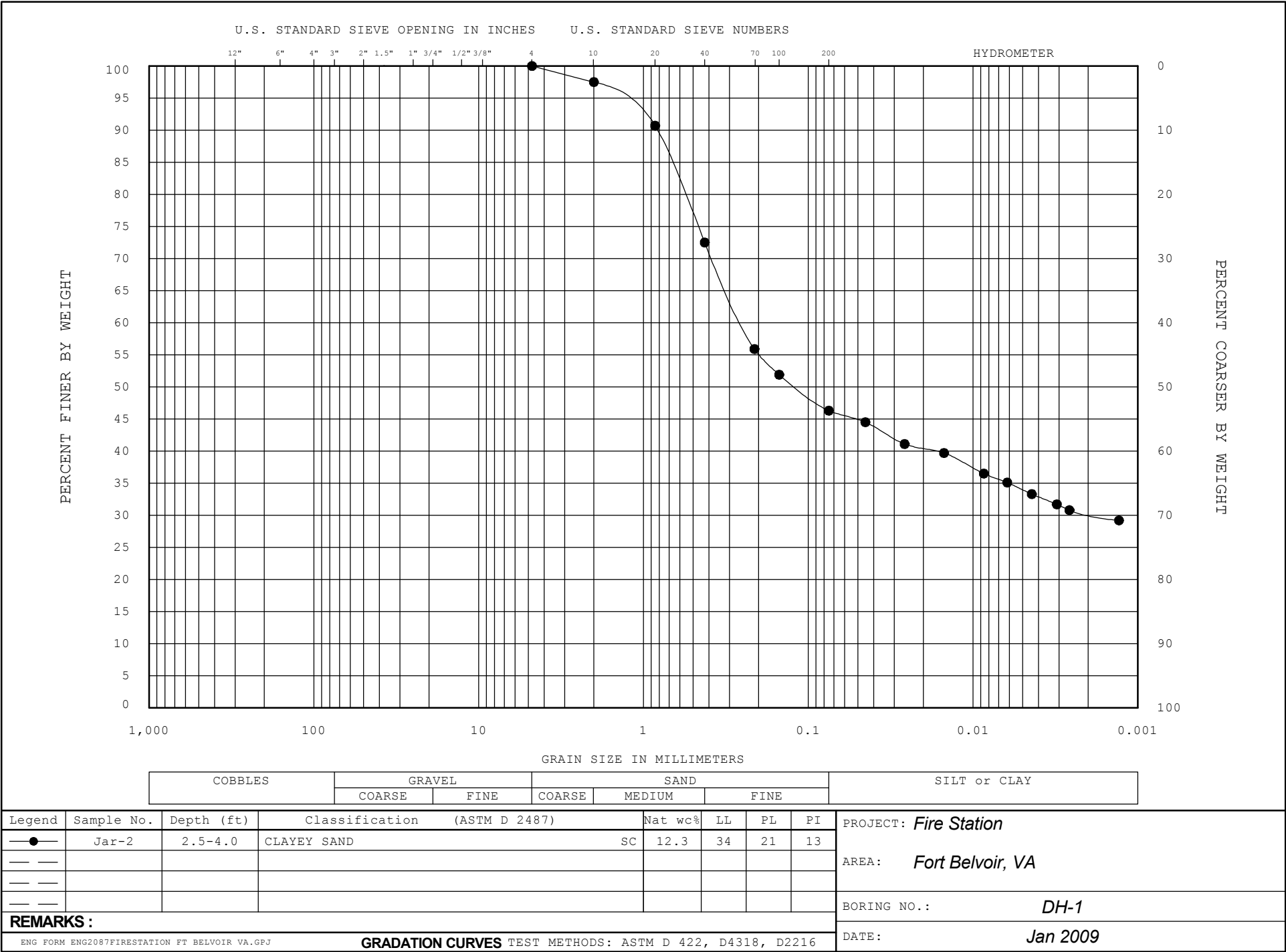
Odex

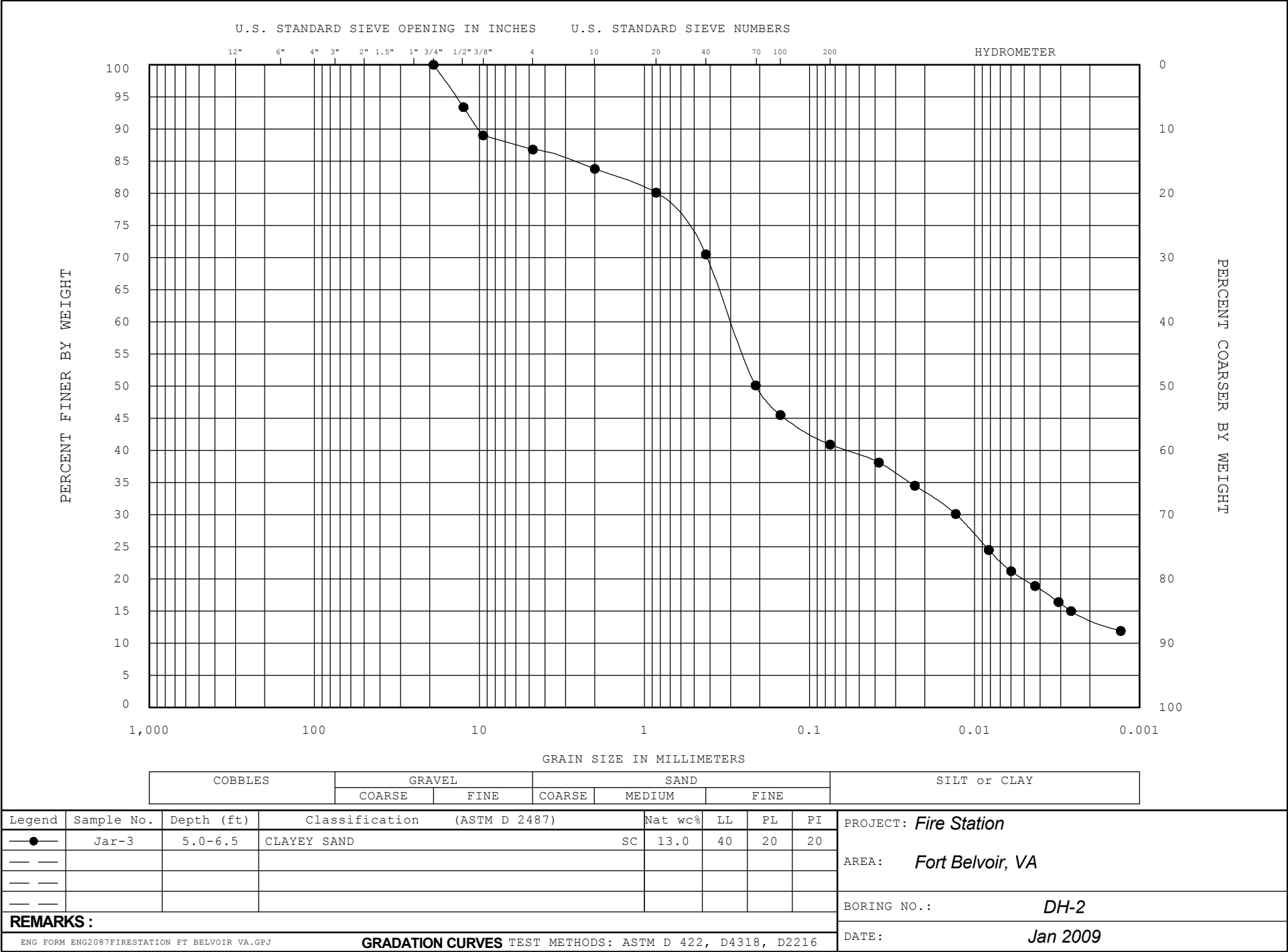


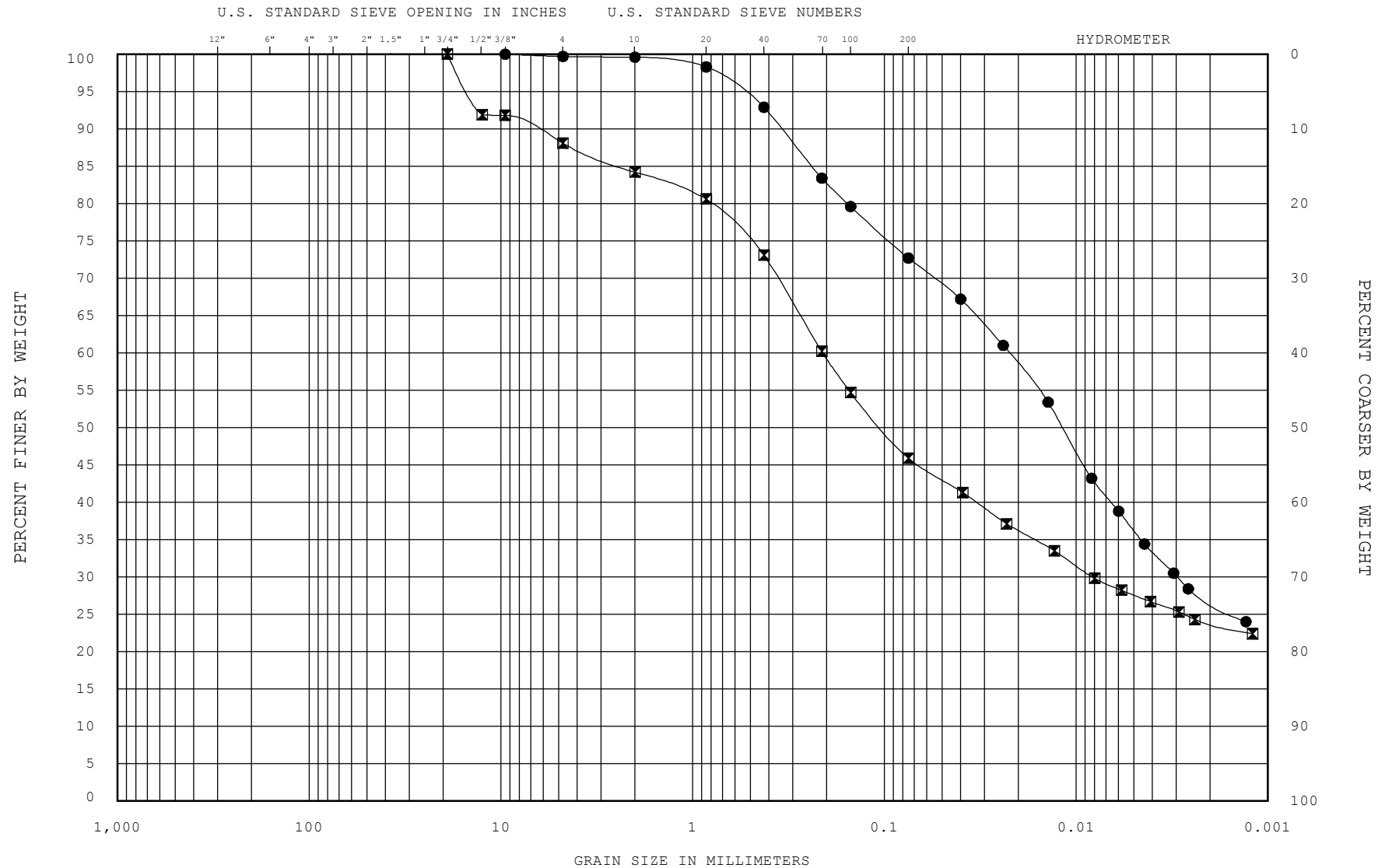
**LABORATORY TEST RESULTS****PROJECT:** Fire Station**DATE:** Jan.2009**AREA:** FortBelvoir, VA**TEST:** Natural Moisture Contents (ASTM D 2216 Method B) & Atterberg Limits (ASTM D 4318)

<u>Hole No.</u>	<u>Sample No.</u>	<u>Depth (ft.)</u>	<u>Moisture Content, %</u>	<u>LL</u>	<u>PL</u>	<u>PI</u>	<u>Atterberg Classification</u>	<u>Symbol</u>
DH-1	Jar-2	2.5-4.0	12.3	34	21	13	Lean Clay	CL
DH-1	Jar-3	5.0-6.5	7.3					
DH-2	Jar-2	2.5-4.0	14.0					
DH-2	Jar-3	5.0-6.5	13.0	40	20	20	Lean Clay	CL
DH-3	Jar-2	2.5-4.0	19.6	42	24	18	Lean Clay	CL
DH-3	Jar-3	5.0-6.5	14.8	48	26	22	Lean Clay	CL
DH-4	Jar-3	2.5-4.0	6.4	34	20	14	Lean Clay	CL
DH-4	Jar-4	5.0-6.5	9.1					
DH-5	Jar-2	2.5-4.0	15.0					
DH-5	Jar-3	5.0-6.5	18.7	53	29	24	Elastic Silt	MH
DH-5	Jar-4	7.5-9.0	12.3	39	22	17	Lean Clay	CL
DH-6	Jar-5	7.5-9.0	13.6					
DH-6	Jar-6	10.0-11.5	14.5					
DH-6	Jar-7	12.5-14.0	25.0					
DH-6	Jar-8	15.0-16.5	20.8					
DH-6	Jar-9	17.5-19.0	21.8					
DH-7	Jar-4	5.0-6.5	19.4					
DH-7	Jar-6	10.0-11.5	26.3					
DH-7	Jar-8	15.0-16.5	12.2					
DH-7	Jar-9	17.5-19.0	13.4					
DH-7	Jar-10	20.0-21.5	14.6					

Note: The Atterberg Limits test is only performed on minus No. 40 material portion of a sample and does not represent the entire sample. Refer to the Visual Classification or the Gradation Analysis for the complete classification.

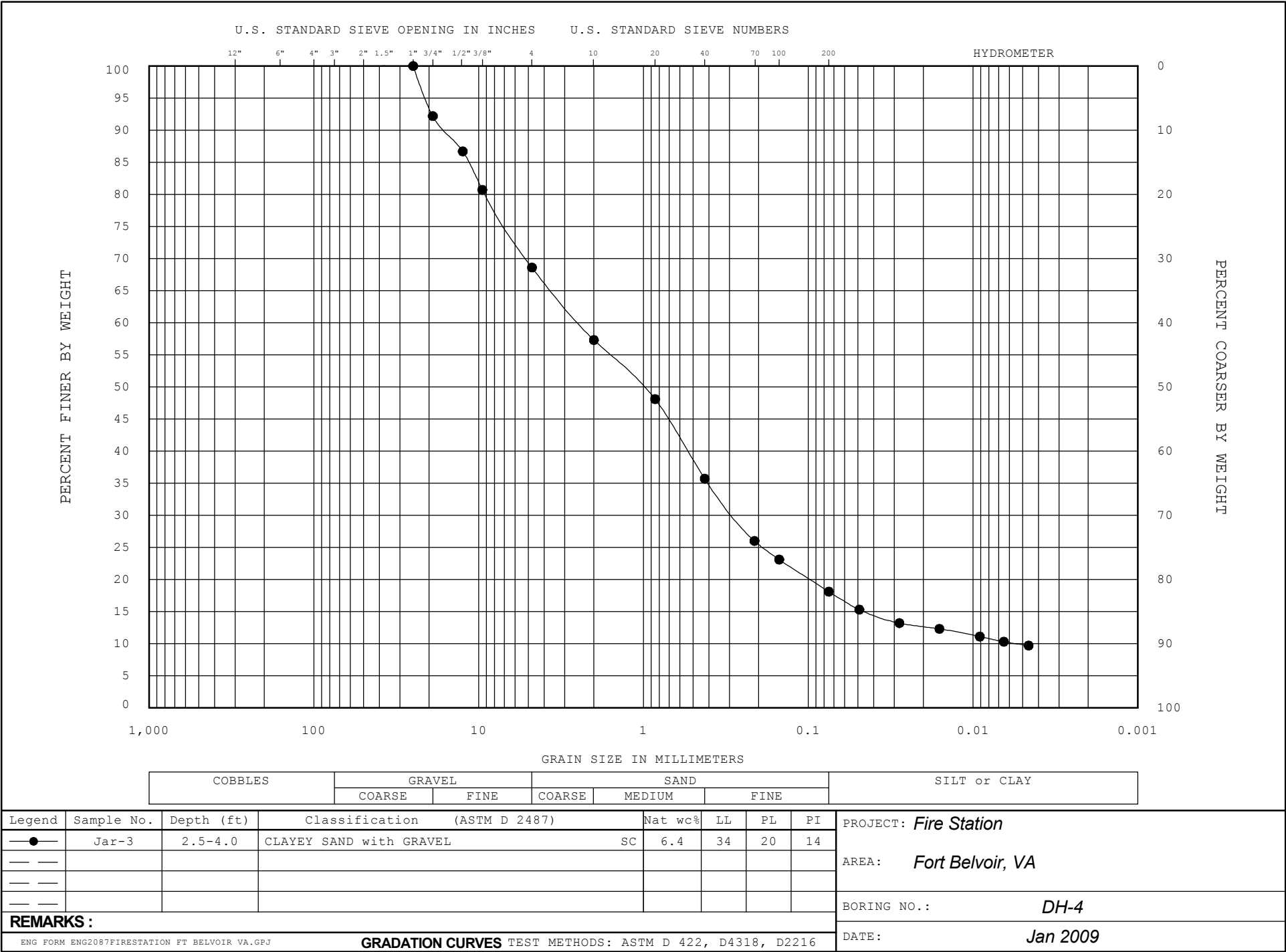


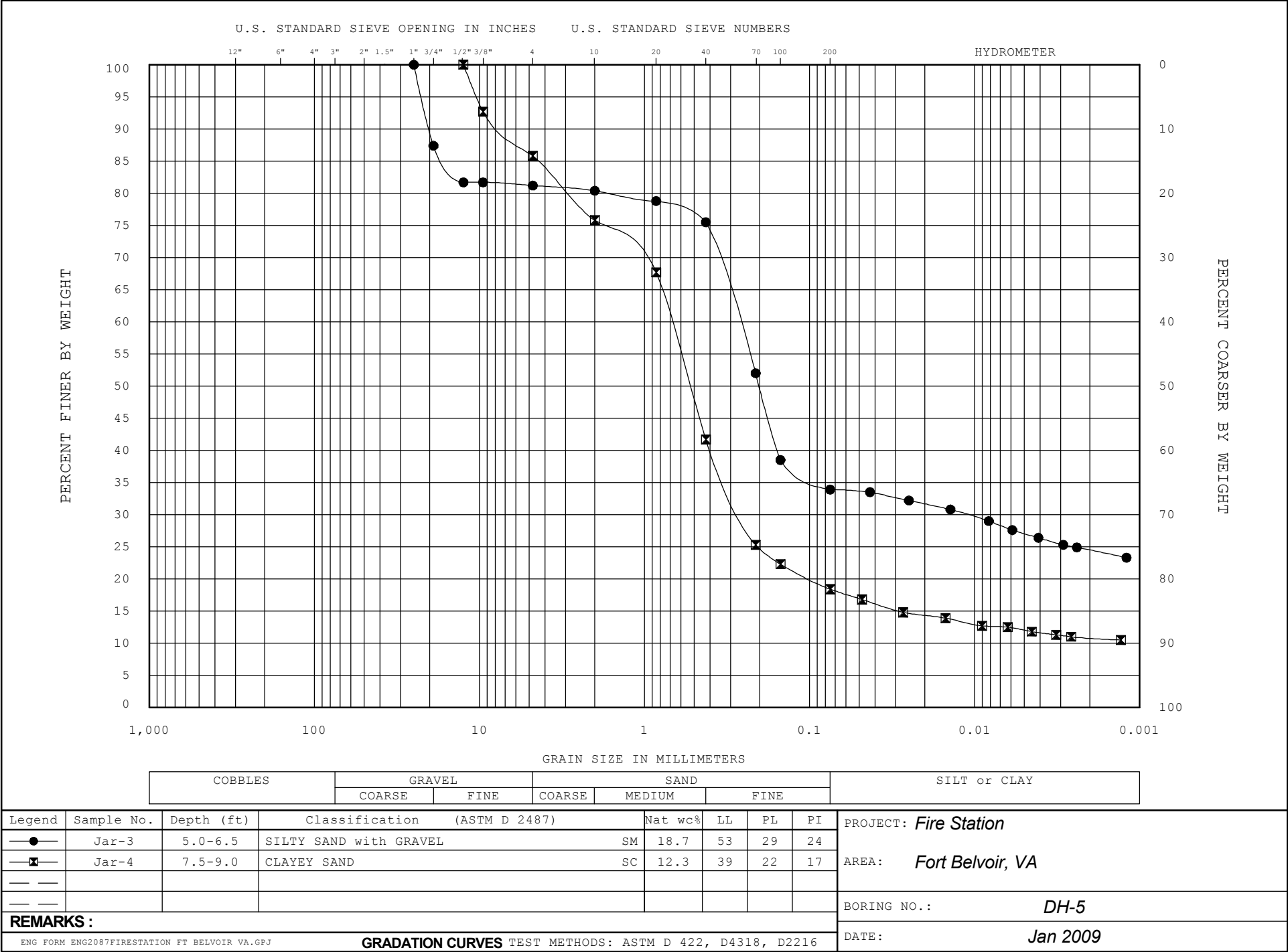


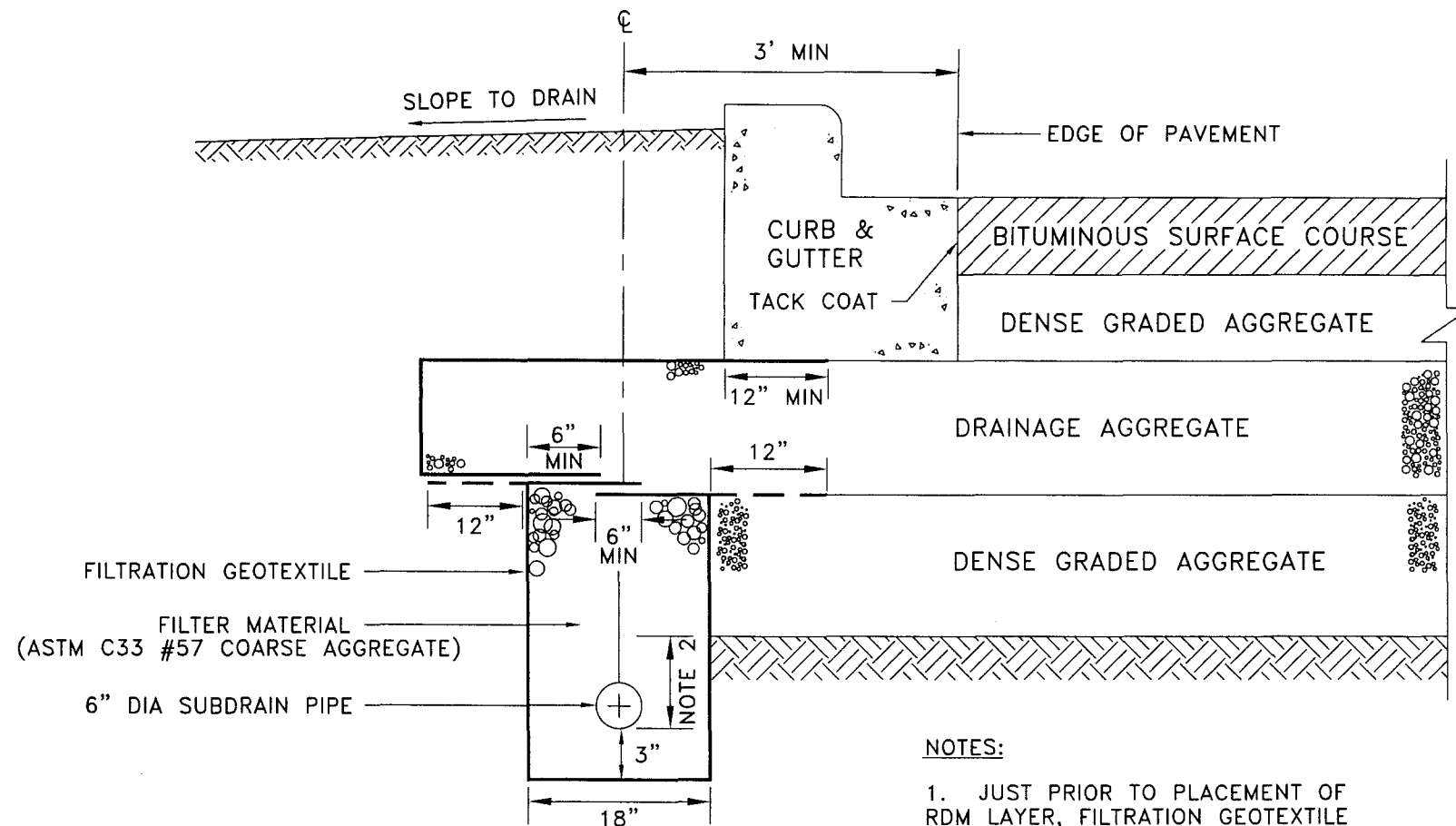


COBBLES	GRAVEL		SAND			SILT or CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Legend	Sample No.	Depth (ft)	Classification (ASTM D 2487)	Nat wc%	LL	PL	PI	PROJECT: <i>Fire Station</i>
—●—	Jar-2	2.5-4.0	LEAN CLAY with SAND	CL	19.6	42	24	18
—■—	Jar-3	5.0-6.5	CLAYEY SAND	SC	14.8	48	26	22
— —								
— —								
REMARKS :								BORING NO.: <i>DH-3</i>
ENG FORM ENG2087FIRESTATION FT BELVOIR VA.GPJ GRADATION CURVES TEST METHODS: ASTM D 422, D4318, D2216								DATE: <i>Jan 2009</i>





**NOTES:**

1. JUST PRIOR TO PLACEMENT OF RDM LAYER, FILTRATION GEOTEXTILE AT TOP OF SUBDRAIN SHALL BE OPENED UP AND LAID BACK ON TOP OF THE UNDERLYING LAYER AS SHOWN. (SEE DASHED LOCATION)
2. VARIES SEE SHT \*\* & \*\*.

**EXAMPLE SUBDRAIN DETAIL**

N.T.S.

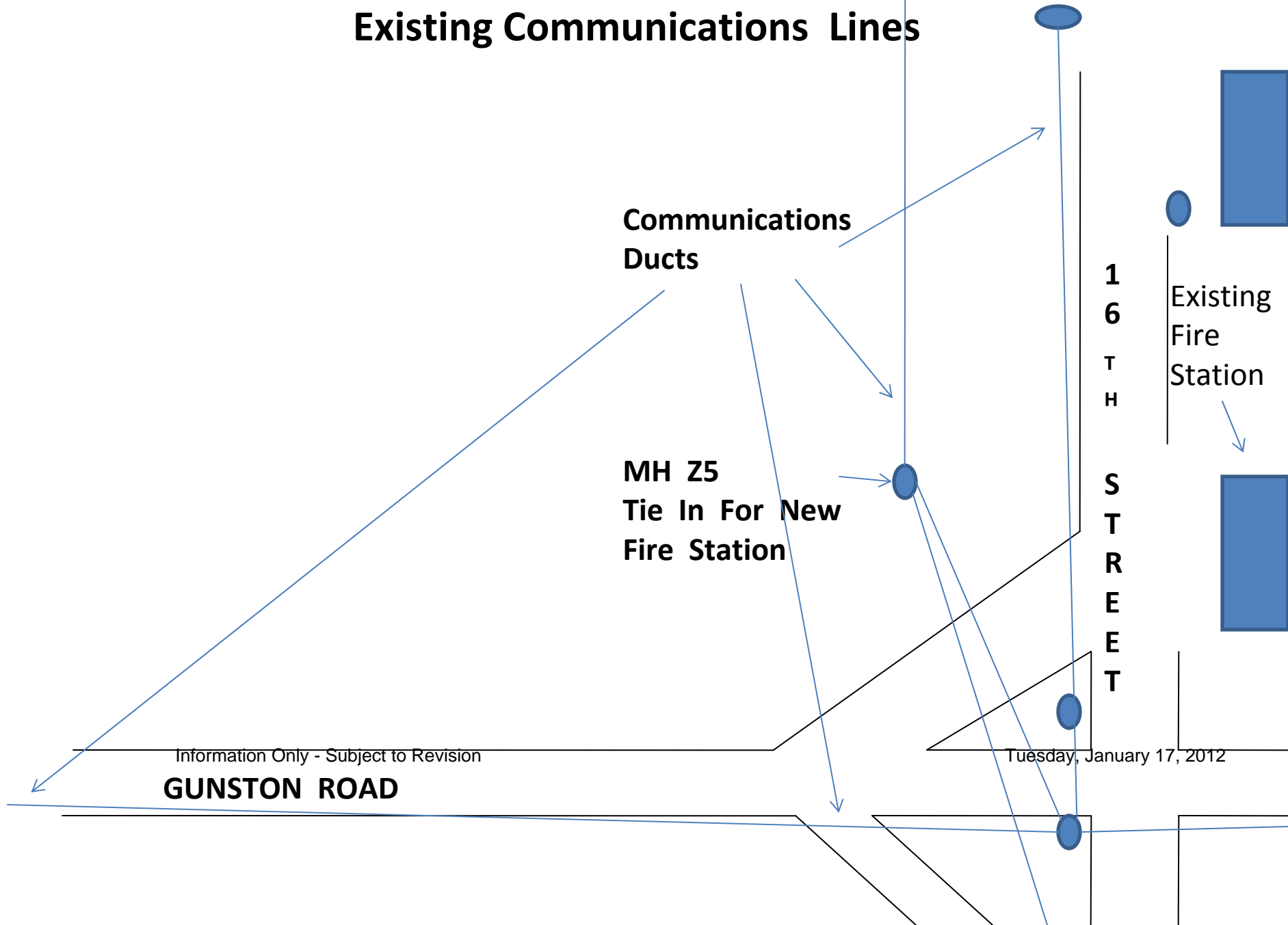
APPENDIX B  
List of Drawings

Not Used



# SOUTH POST FIRE STATION, PROPOSED

## Existing Communications Lines



D751

For use in this form, see A11-120 90 the preparation agency is USACE

## WATER FLOW TEST

LOCATION

Bldg. 191

Wd. #1-06

DATE

15 Oct 08

HYDRANT  
NUMBEROUTLET DIAMETER  
(inches)PITOT PRESSURES  
(PSI)DISCHARGE  
(Gallons per Minute)

STATE

44

RESIDUAL PSI

34

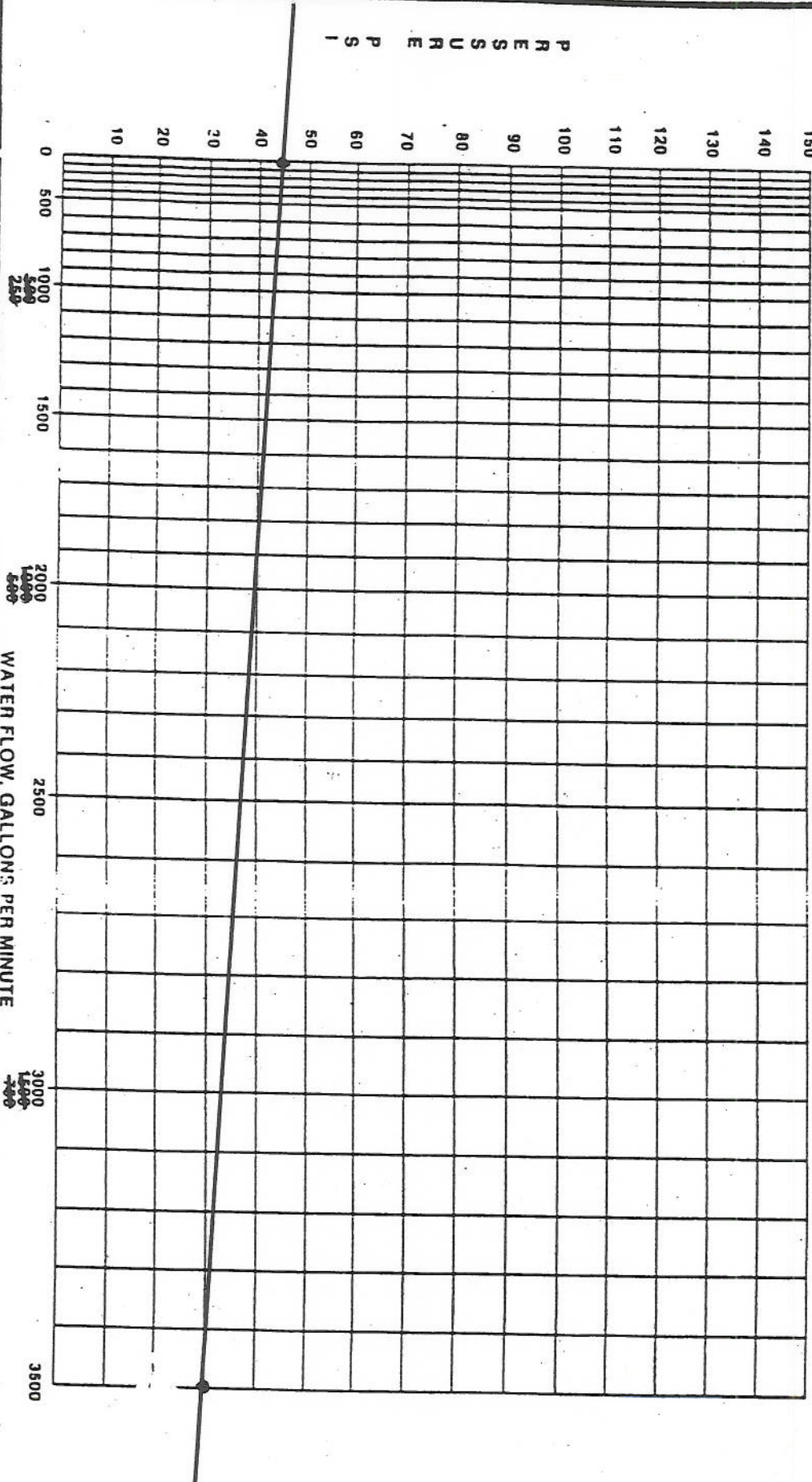
AVAILABLE GALLONS PER MINUTE  
(At 20 PSie)

5625

11-22  
11-22  
11-23  
11-232.5  
2.5  
2.5  
2.530  
30  
30  
30914  
914  
914  
914TOTAL DISCHARGE DURING TEST  
(Gallons per Minute)

3516

840 WATER FLOW CHART



## Record of Environmental Consideration

**PROJECT TITLE:** Replace Fire Station**PROJECT NUMBER/ UO Number:** N/A**PROPONENT OF THE ACTION:** US Army Garrison Fort Belvoir, VA**DESCRIPTION OF THE ACTION:** Construct new fire station to replace existing Fort Belvoir fire station located at 16<sup>th</sup> Street and Gunston Road.**ANTICIPATED DATE AND/OR DURATION OF THE PROPOSED ACTION:** Construction begins March 2010 and continues for 12 months**IT HAS BEEN DETERMINED THAT THE ACTION (CHOOSE ONE):**

- ☐ 1. Is covered by an existing [ ] EA; [ ] EIS;  
Entitled Dated:
- ☒ 2. Is categorically excluded under the provisions of CX (c)(1), AR 200-2, 32 CFR part 651, appendix B, section ii, because the project entails construction on previously disturbed land no exceeding 5.0 acres.

- General Conformity under the Clean Air Act, Section 176 has been evaluated under the requirements of 40 CFR 93, Subpart B and the Record of Non-Applicability is attached.
- This project is located within the Fort Belvoir Historic District. Section 106 Consultation will require design review by SHPO.

(and no extraordinary circumstances exist as defined in 32 CFR part 651.29(b).)

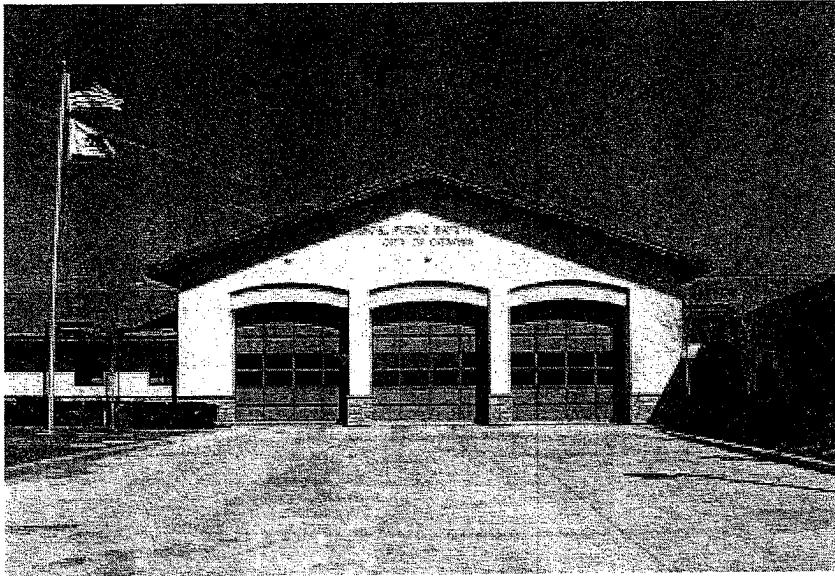
**SIGNATURE OF PREPARER:** Mary Jo Brooks**PHONE NUMBER:** 703-806-3008**DATE:** 8 June 2009**For Environmental Office Use Only**

THE ENVIRONMENTAL OFFICER ☒ CONCURS ☐ DOES NOT CONCUR WITH THE ABOVE DETERMINATION.  
EXPLANATION (CONTINUE ON BACK IF NECESSARY):

**NAME OF ENVIRONMENTAL OFFICER (PRINT/TYPE):** Bill Sanders**SIGNATURE:****PHONE NUMBER:** 703-806-3017**DATE:** 

## Appendix F

Refer to the Fort Belvoir Installation Design Guide as well as the accompanying photos to establish the desired site and architectural themes for the project.



#### KEY DESIGN POINTS

- Simplicity of Design--simple form
- Good massing and scale
- Gable or simple hip roof design
- Defined base element, body, & cap
- Brick exterior
- Operable windows
- Equipment bays larger element
- Installation Design Guide compliant
- SHPO approval process required



Examples shown are for general guidance and are not intended to represent a final approved product.















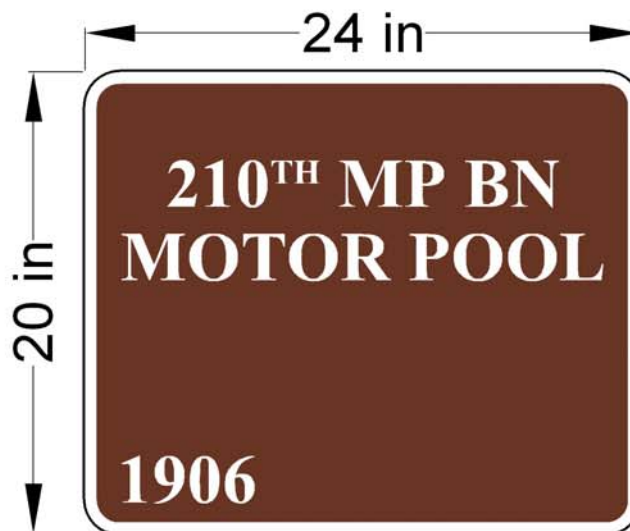




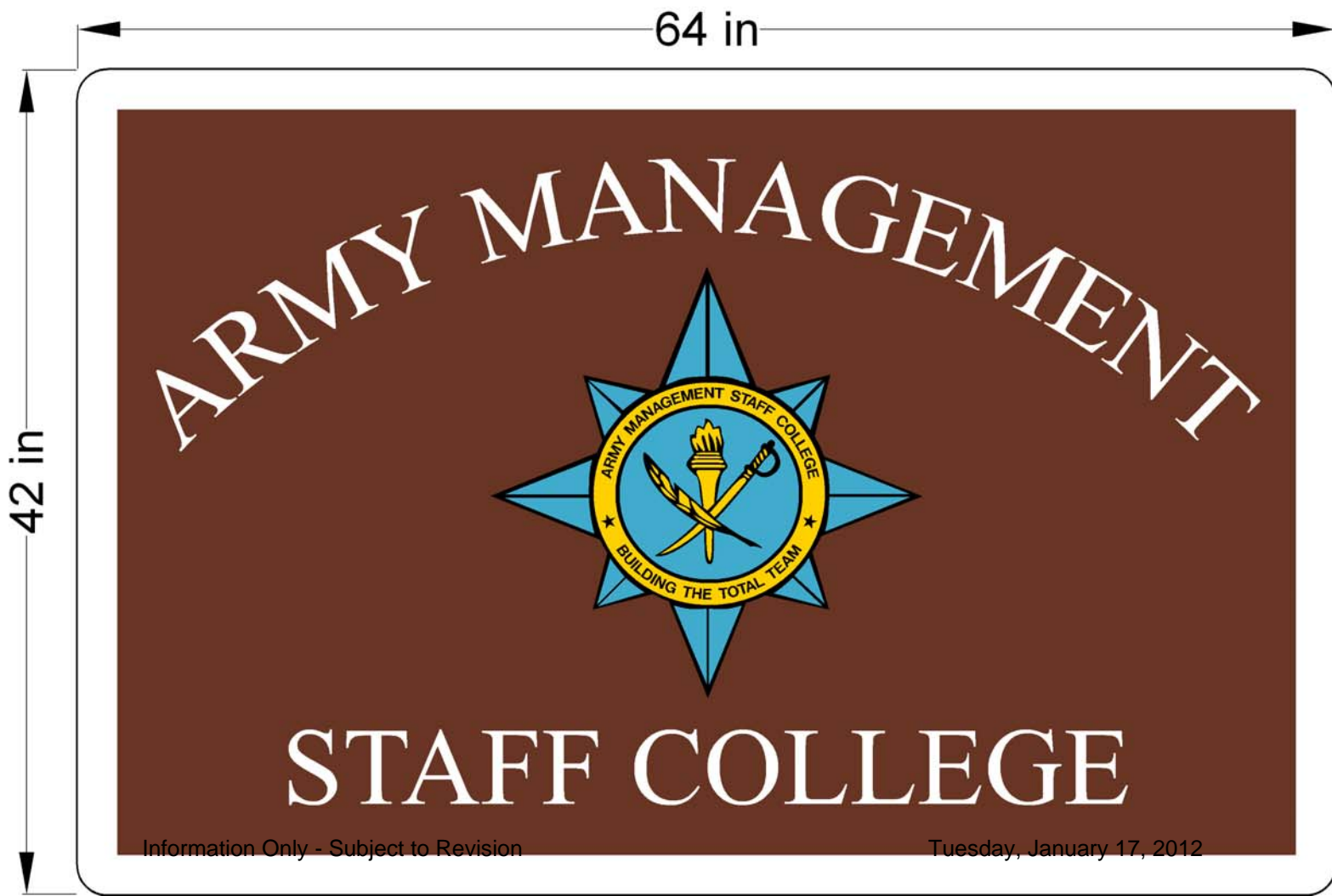


## APPENDIX G GIS Data

Not Used



TYPICAL FRONT MAIN SIGN INSTALLED ON 6"X6" POSTS PAINTED FT BELVOIR BROWN  
1.5" HDU ROUTERED SIGN WITH RAISED BORDER AND TEXT  
FULL COLOR DIGITAL LOGO WITH UV PROTECTION OVER LAMINATE



**Approved Plant List for Fort Belvoir**

30January2009

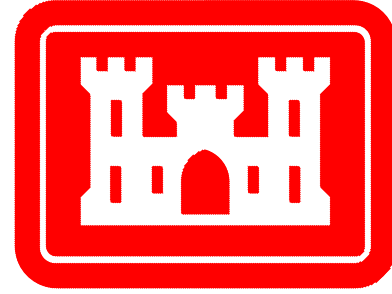
- 1) Large street trees: 2.5-3" Dutch Elm Disease resistant American elm cultivar (*Ulmus americana* 'Valley Forge', 'New Harmony', 'Jefferson', or 'Princeton', best if mixed), willow oak (*Quercus phellos*), Shumard oak (*Quercus shumardii*), swamp white oak (*Quercus bicolor*).
- 2) Large lawn trees (12' or farther away from sidewalk and/or paved areas): 2.5-3" scarlet oak (*Quercus coccinea*), pin oak (*Quercus palustris*), sugar maple (*Acer saccharum*), 7-8' Southern magnolia (*Magnolia grandiflora*).
- 3) Evergreen screening: 7-8' Nellie R. Stevens holly (*Ilex* x 'Nellie R. Stevens'), Oriental spruce (*Picea orientalis*), Serbian spruce (*Picea omorika*), Eastern redcedar cultivars (*Juniperus virginiana* 'Canaertii', 'Elegantissima', 'Keteleeri', 'Manhattan Blue'), Foster holly (*Ilex* x *attenuata* 'Fosteri'), American holly cultivars (*Ilex opaca* 'Jersey Princess', 'Old Heavy Berry').
- 4) Small and medium street trees: 6-7' 'Winter King' southern hawthorn (*Crataegus viridis* 'Winter King'), 2.5-3" Seedless sweet gum (*Liquidambar styraciflua* 'Rotundiloba').
- 5) Trees for narrow planting situations: 2.5-3" Green Pillar oak (*Quercus palustris* 'Green Pillar'), upright English oak (*Quercus robur* Rosehill 'Asjes'), upright European hornbeam (*Carpinus betulus* 'Fastigiata').
- 6) Flowering ornamental trees: 7-8' Downy serviceberry (*Amelanchier arborea*), Appalachian Spring dogwood (*Cornus florida* 'Appalachian Spring'), native flowering and Kousa dogwood hybrids (*Cornus* X 'Rutcan', *Cornus* X 'Stellar® Series'), Carolina Silverbell (*Halesia carolina*), 'Henry Hicks' sweetbay magnolia (*Magnolia virginiana* 'Henry Hicks').
- 7) Shrubs (sun): Virginia sweetspire (*Itea virginica* 'Little Henry' or 'Henry's Garnet'), large fothergilla (*Fothergilla major*), chokeberry (*Aronia* spp.), winterberry (*Ilex verticillata*), dwarf fothergilla (*Fothergilla gardenii*), sweet pepperbush (*Clethra alnifolia*), northern bayberry (*Myrica pensylvanica*), box sandmyrtle (*Leiophyllum buxifolium*), New Jersey tea (*Ceanothus americanus*), Blue Muffin viburnum (*Viburnum dentatum* 'Blue Muffin'), inkberry (*Ilex glabra* 'Shamrock' or 'Densa').
- 8) Shrubs (shade): oakleaf hydrangea (*Hydrangea quercifolia*), Annabelle hydrangea (*Hydrangea aborescens* 'Annabelle'), garden glow dogwood (*Cornus hessei* 'Garden Glow'), gold dust dwarf aucuba (*Aucuba japonica* 'Variegata nana'), Goshiki osmanthus (*Osmanthus heterophyllus* 'Goshiki'), Midwinter Fire bloodtwig dogwood (*Cornus sanguinea* 'Midwinter Fire'), Ivory Halo tartarian dogwood (*Cornus alba* 'Ivory Halo' or 'Bailhalo'), yellow twig dogwood (*Cornus sericea* 'Flaviramea'), pinxterbloom azalea (*Rhododendron periclymenoides*), P.J.M. rhododendron (*Rhododendron* x 'P.J.M.').

**Approved Plant List for Fort Belvoir**

30January2009

9) Perennials (sun): purple coneflower (*Echinacea purpurea* 'Magnus' or 'White Swan'), perennial Black-eyed Susan (*Rudbeckia fulgida* 'Goldsturm'), yarrow (*Achillea millefolium*), red columbine (*Aquilegia canadensis*), New England aster (*Symphyotrichum novae-angliae*), Joe Pye weed (*Eupatorium maculatum*).

10) Perennials and ferns (shade): hosta (*Hosta* spp.), bee balm (*Monarda didyma* 'Gardenview Scarlet' or 'Jacob Cline'), Alleghany pachysandra (*Pachysandra procumbens*), creeping phlox (*Phlox stolonifera* 'Sherwood Purple'), Christmas fern (*Polystichum acrostichoides*), cinnamon fern (*Osmunda cinnamomea*), New York fern (*Thelypteris noveboracensis*), ostrich fern (*Matteuccia struthiopteris*).



# US Army Corps of Engineers

Huntsville Center

TWO COMPANY SATELLITE  
FIRE STATION  
FORT BELVOIR, VIRGINIA  
FY09 61453

Solicitation Number W912DR-09-R-0061



ARMY CORPS  
ENGINEERS

DWN BY: KP / BDH	CKD BY:	SOLICITATION NO.:
SUBMITTED BY:	PROJECT NO.:	PNG1453
FILE NAME: RFP SHEETS.DGN	CATEGORY CODE:	
SIZE:	PLOT SCALE:	PLOT DATE:

CORPS OF ENGINEERS  
HUNTSVILLE CENTER

Fire Station  
Fort Belvoir, VA

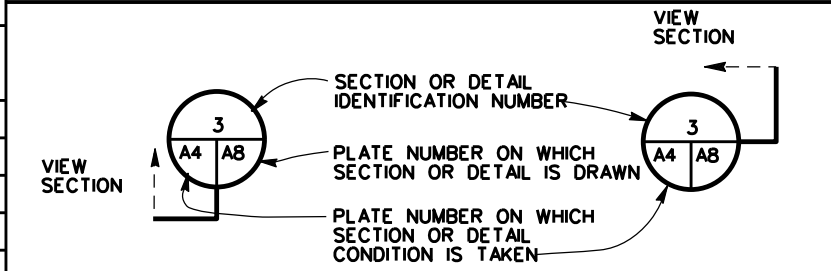
LATE  
NUMBER

SHEET 6 OF 9

# INDEX OF DRAWINGS

[illegible]

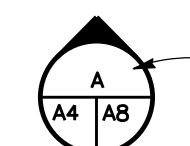
## SECTION SYMBOLS



SYMBOL WHERE SECTION IS TAKEN



TITLE WHERE SECTION IS DRAWN


















— IDENTIFICATION LETTER WHERE  
ELEVATION IS TAKEN



ELEVATION SYMBOL

## MATERIAL INDICATIONS

	EARTH (ORIGINAL GRADE)
	EARTH (COMPACTED FILL)
	GRAVEL
	CONCRETE
	MORTAR - CEMENT - PLASTER - STUCCO
	CONCRETE MASONRY UNITS (C.M.U., SMALL SCALE - PLAN)
	CONCRETE MASONRY UNITS (C.M.U., LARGE SCALE - SECTION)
	CONCRETE MASONRY UNITS OR HOLLOW TILE (SMALL SCALE - SECTION)
	METAL (ELEVATION)
	STEEL (CROSS SECTION)
	INSULATION (RIGID)
	INSULATION (LOOSE OR BATT)
	BRICK
	WOOD (BLOCKING)
	WOOD (FINISH)

STANDARD ABBREVIATIONS

A	A.C.	AIR CONDITIONED	CKT.	CIRCUIT	ELEC.	ELECTRIC	H		L		OL.	OVERLOAD	REG.	REGISTER	TEL.	TELEPHONE
A.D.	AIR DRAIN		CL.	CENTER LINE	EQUIP.	EQUIPMENT	H.	HIGH	LB.,*	POUND	OPNG.	OPENING	REINF.	REINFORCING	TEMP.	TEMPERATURE
A.H.U.	AIR HANDLING UNIT		CEIL.	CEILING	E.W.C.	ELECTRIC WATER COOLER	H.B.	HOSE BIBB	LG.	LONG	OPP.	OPPOSITE	REQ.	REQUIRED	THK.	THICKNESS
ALT.	ALTERNATE		CL.	CLOSET	EXH.	EXHAUST	H.C.	HOLLOW CORE	L.P.	LIGHTING PANEL	O.S.D.	OPEN SIGHT DRAIN	RET.	RETURN	THD.	THRESHOLD
ALUM.	ALUMINUM		C.M.U.	CONCRETE MASONRY UNIT	EXP. JT.	EXPANSION JOINT	HT.	HEIGHT	LTG.	LIGHTING			R.G.	RETURN GRILLE	TOIL.	TOILET
AMP., A.	AMPERES		C.O.	CLEAN OUT	EXT.	EXTERIOR	H.M.	HOLLOW METAL					R.M.	ROOM	TYP.	TYPICAL
APPROX.	APPROXIMATELY		COL.	COLUMN	EXIST.	EXISTING	H.P.	HORSE POWER			P		R.P.M.	REVOLUTION/MINUTE		
ARCH.	ARCHITECTURAL		A.O.	ACCESS OPENING			HR.	HOUR	M		P.	PAPER				
A.T.	ASPHALT TILE		COND.	CONDENSATE	F	FIRE ALARM	HTG.	HEATING	M.	MOTOR	PART.	PARTITION	S	SUPPLY	V	VOLT
A.T.C.	ACOUSTIC TILE CEILING		CONN.	CONNECTION	F.A.	FIRE ALARM	HTR.	HEATER	MAINT.	MAINTENANCE	PER.	PERIMETER	S.	SUPPLY AIR	V.	VINYL ASBESTOS TILE
			CONST.	CONSTRUCTION	F.C.	FLEXIBLE CONNECTION	H.&V.	HEATING AND VENTILATING	MAX.	MAXIMUM	R, PL.	PLATE	S.A.	SCHEDULE	V.A.T.	VENTILATION
			CONT. JT.	CONTRACTION JOINT	F.D.	FLOOR DRAIN	HYD.	HYDRANT	M.D.P.	MAIN DISTRIBUTION PANEL	PLB.G.	PLUMBING	SCH.	SECTION	VERT.	VERTICAL
			C.S.C.	COLOR SYMBOL CODE	F.E.C.	FIRE EXTINGUISHER CABINET			MECH.	MECHANICAL	PLYWD	PLYWOOD	SERV.	SERVICE	VTR	VENT THRU ROOF
			C.T.	CERAMIC TILE	FIN.	FINISH			MTL.	METAL	PANEL.	PRESS.	SHT.	SHEET		
B	BAL.	BALANCE	C.T.B.	CERAMIC TILE BASE	FT.	FLOOR	I	INSIDE DIAMETER	MISC.	MISCELLANEOUS	PSF	POUNDS/SQUARE FOOT	S.J.	SLIP JOINT	W	WATT
BD.	BOARD	BOARD	C. TO C.	CENTER TO CENTER	FTG.	FOOT, FEET	I.D.	INVERT ELEVATION	M.O.	MASONRY OPENING	PSI	POUNDS/SQUARE INCH	SPEC.	SPECIFICATIONS	W.	WITH
BLDG.	BUILDING	BUILDING					I.E.	INCHES	M.T.	METAL THRESHOLD	PSIG	POUNDS/SQUARE INCH GAGE	SO. FT.	SQUARE FEET	WC	WAINSCOTING
BLK.	BLANK	BLANK					IN.	INCHES	MTD.	MOUNTED	PT.	POINT	ST.	STEEL	WD.	WOOD
BM.	BEAM	BEAM					INCAND.	INCANDESCENT	MTG.	MOUNTING	PTD.	PAINTED	STOR.	STORAGE	W.D.	WINDOW DIMENSION
BOT.	BOTTOM	BOTTOM					INSUL.	INSULATION	M.V.	MECHANICAL VENTILATION			STRUC.	STRUCTURAL	WF	WIDE FLANGE
BRC.	BEARING	BEARING					INT.	INTERIOR	M.G.T.	MATT GLAZE TILE	Q	QUARTER	SUSP.	SUSPENDED	W.G.	WATER GAGE
B.T.U.H.	BRITISH THERMO UNIT/HOUR	BRITISH THERMO UNIT/HOUR									QTR.	QUANTITY	SW.	SWITCH	WP.	WEATHERPROOF
			D	DETAIL	G	GAGE	J	JUNCTION BOX	N	NOT APPLICABLE	QUAN.	QUANTITY	T	TOILET	WTR.	WATER
			DET.	DIAMETER	GA.	GALLON	J.B.	JUNCTION BOX	N.A.	NOT IN CONTRACT			T.		W.W.F.	WELDED WIRE FABRIC
			DIA.	DIFFUSER	GAL.	GALLON	JCT.	JUNCTION	N.C.	NUMBER						
			DIFF.	DIMENSION	GALV.	GALVANIZED	JT.	JOINT	O	OUTDOOR AIR	R	RISER				
			DM.	DISCONNECT	G.F.E.	GOVERNMENT FURNISHED			O.A.		R.A.	RETURN AIR				
			DISC.	DUMMY JOINT		EQUIPMENT					RAD.	RADIUS				
			D.J.	DOWN		GL.					RD.	ROUND				
			DN.	DRAIN		GND.										
			DR.	DOWN SPOUT		GOV'T										
			D.S.	DRAWING(S)		G.P.H.										
			DWG.(S)			G.P.M.										
						GR.										
			E	EACH	G.W.B.	GYPSSUM WALL BOARD	K	KILOVOLT AMPERE								
			EA.				KVA									

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$$$SYSTEMS
$$$USERnames$$$
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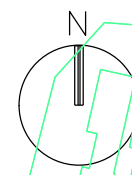


**D**

C

**B**

A



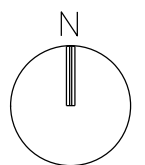
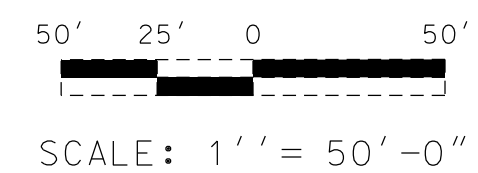
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SSSYTIMESS
SSUSERNAMESS

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LEGEND



ARMY CORPS  
ENGINEERS

[illegible]

U.S. DEPARTMENT OF THE ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER	SOLICITATION NO.:	
	DRAWN BY: KP / BDH	CKD BY:
	SUBMITTED BY:	
	PROJECT NO.:	
	PN61453	
FILE NAME: RFP SHEETS.DGN		
CODE CODE:		
PLOT SCALE: SIZE: 11" x 17"		PLOT DATE: MAY 2011

Fire Station  
Fort Belvoir, VA

## LATE WINTER

CD-101  
ET 3 OF 9













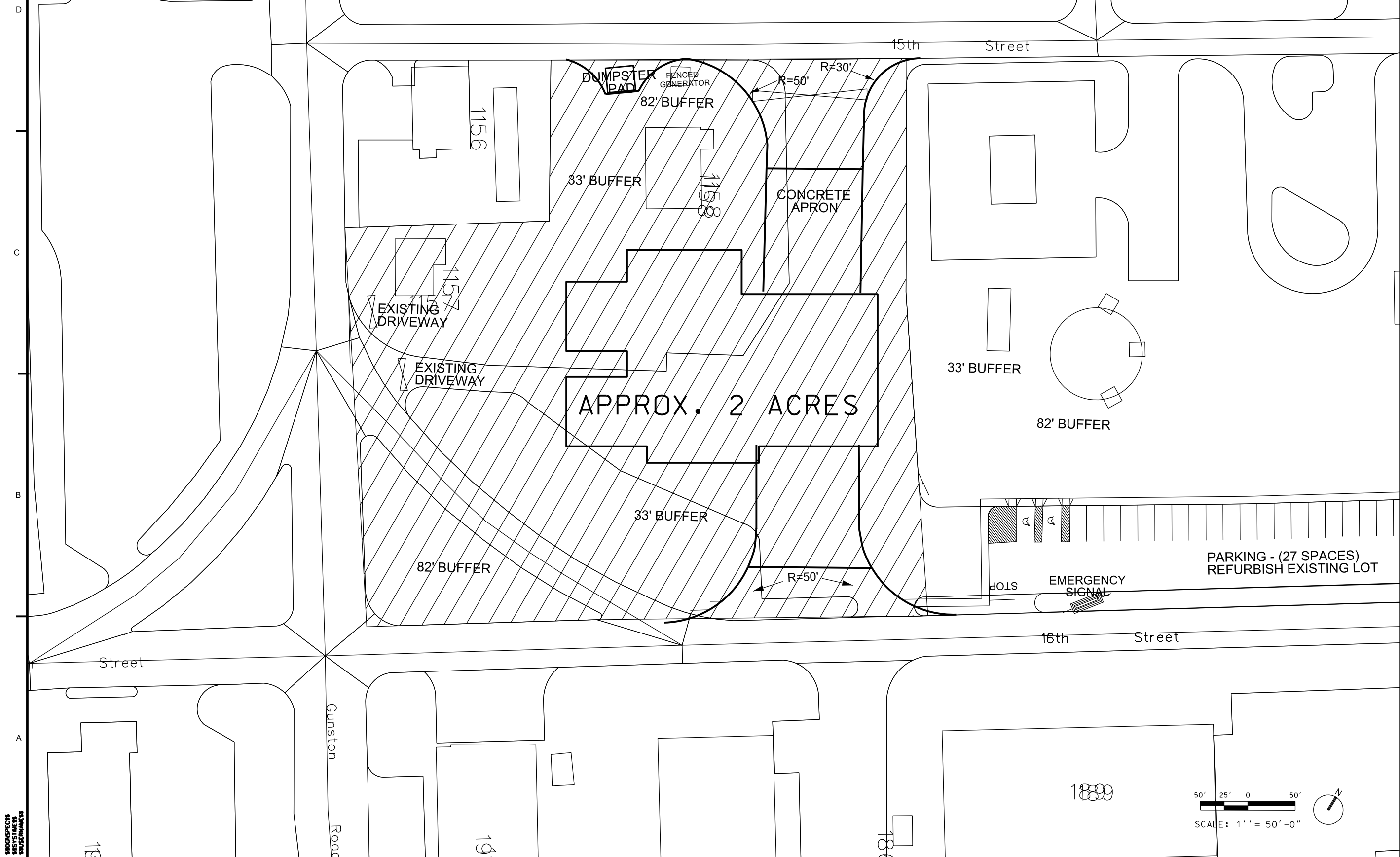




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DESIGNED BY:	DATE:
DRAWN BY:	SOLICITATION NO.:
SUBMITTED BY:	PROJECT NO.:
TITLE NAME:	CATEGORY CODE:
SIZE:	PLOT SCALE:
	PLOT DATE:

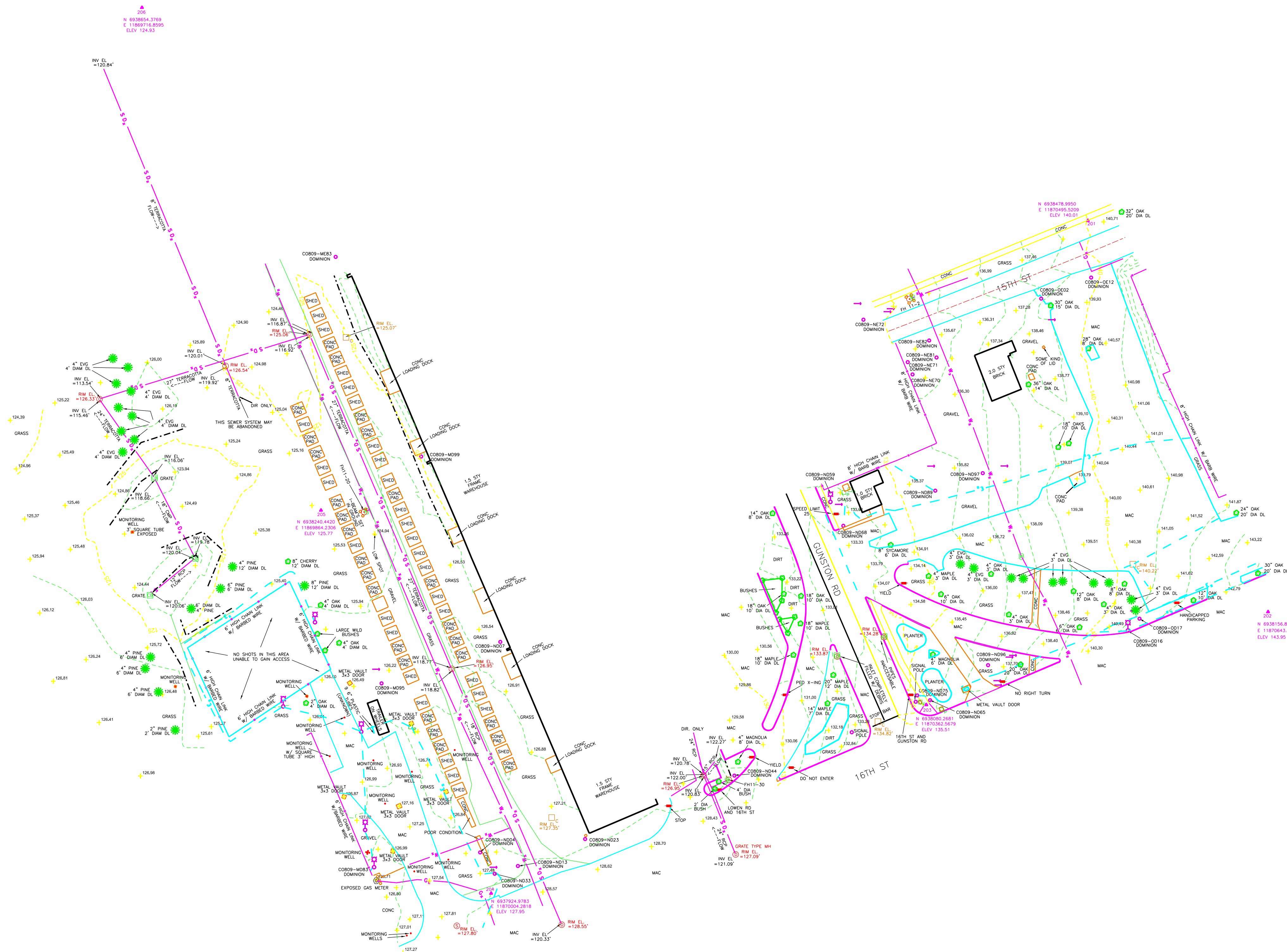
J. S. ARMY ENGINEER DISTRICT  
CORPS OF ENGINEERS  
HUNTSVILLE CENTER

Two Company Satellite Fire Station Fort Belvoir, VA	
---	--

PLATE  
NUMBER



NOTES:  
1. CAD FILES OF SURVEY AVAILABLE UPON REQUEST.


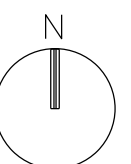


### LEGEND

- |   |                    |   |                  |   |                     |
|---|--------------------|---|------------------|---|---------------------|
|  | SAN, SEWER M.H.    |  | DECIDUOUS TREES  |  | TRAVERSE POINT      |
|  | STORM DRAIN M.H.   |  | CONIFEROUS TREES |  | GUY WIRE/POLE       |
|  | GAS METER          |  | FIRE HYDRANT     |  | TOP/BOTTOM OF DITCH |
|  | ELEC. JUNCTION BOX |  | SPOT GRADE       |  | U/G ELECTRIC        |
|  | ELECTRIC POLE      |  | WELL             |  | U/G GAS LINE        |
|  | TELEPHONE M.H.     |  | WATER VALVE      |  | U/G WATER LINE      |
|  | CATCH BASIN        |  | SIGN             |  | U/G STORM DRAIN     |
|  | BOLLARD            |  | LIGHT POLE       |   |                     |

50' 25' 0 50'

SCALE: 1" = 50'-0"



S ARMY CORPS  
F ENGINEERS

KP7 BDH	DWN BY: KP7 BDH	OKD BY:	SOLICITATION NO.:	MAY 2011
	SUBMITTED BY:		PROJECT NO.:	
			PN61453	
			CATEGORY CODE:	
			FILE NAME:	
			RFP SHEETS.DGN	
	SIZE:	PLOT SCALE:	PLOT DATE:	

J. S. ARMY ENGINEER DISTRICT  
CORPS OF ENGINEERS  
HUNTSVILLE CENTER

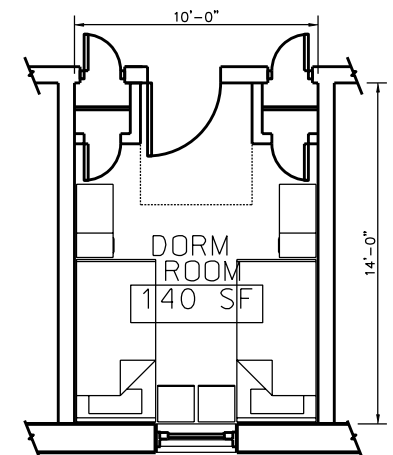
Fire Station  
Fort Belvoir, VA

PLATE  
NUMBER

V-101  
ET 4 OF

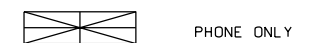



Sheet  
reference  
number:  
**A-1**  
Sheet 1 of 1



2 DORM ROOM WALL  
LOCKER OPTION- 1  
A-1 SCALE: 1' - 0"=1/4"

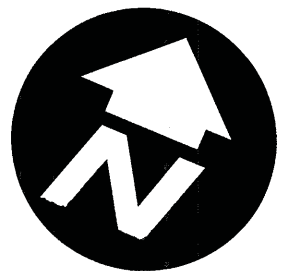
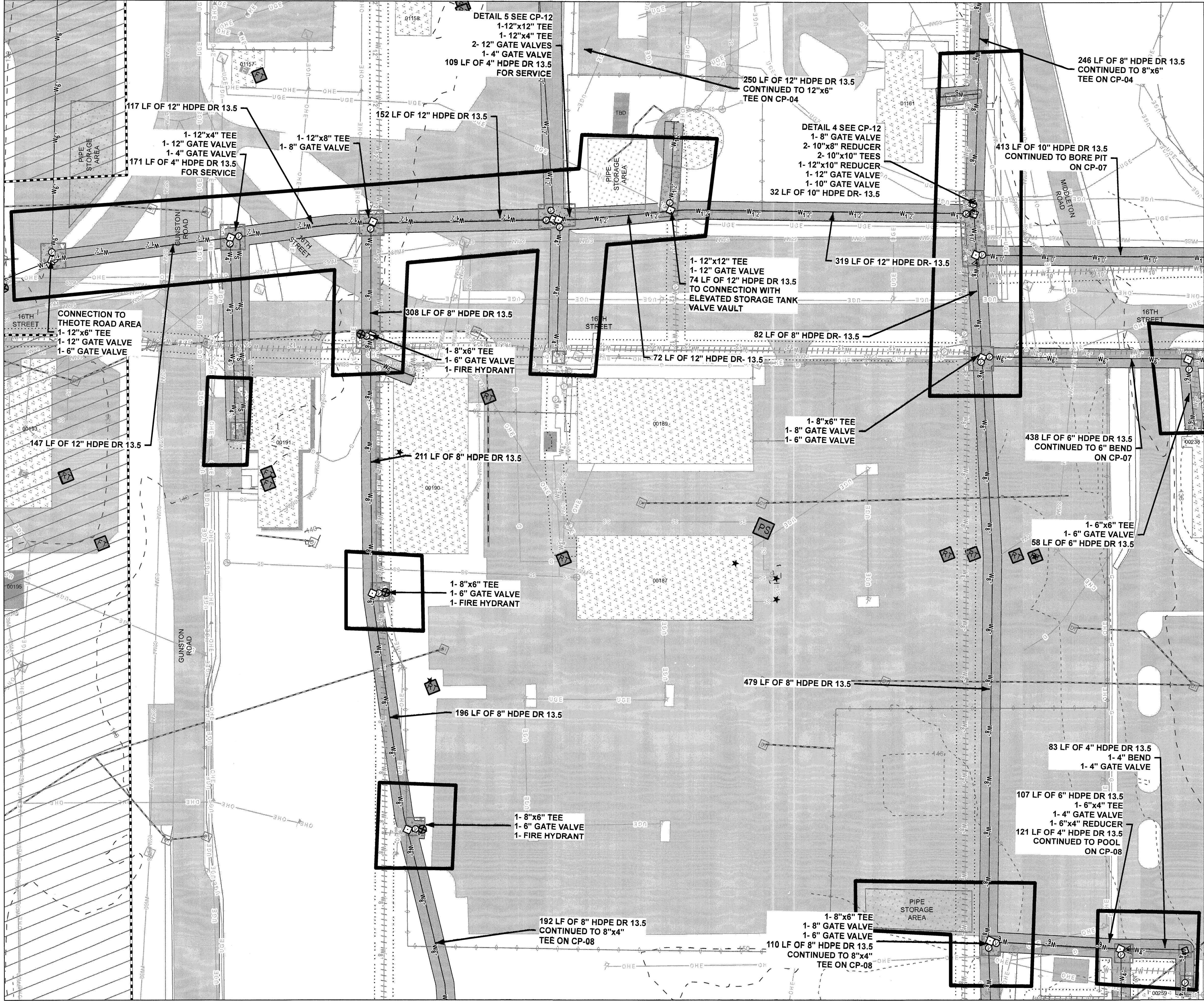
### LEGEND




 FORT BELVOIR- MODIFIED  
 TWO COMPANY SATELLITE FIRE STATION  
 SCALE: 1' - 0"=1/8" 14,943 SQ.FT.

FIRST FLOOR= 14,903 SF  
CANOPY= 40 SF  
GROSS TOTAL= 14,943 SF

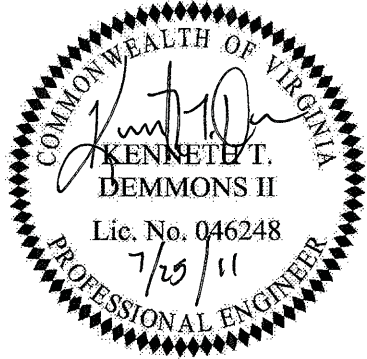




LEGEND

- BEND
- FIRE HYDRANT
- REDUCER
- TEE
- VALVE
- Existing Fire Hydrant
- Existing Water Reducer
- Existing Water Valve
- Post Indicator Gate Valve
- Water Sample Point
- Existing Water Pump Station
- Abandoned Water Lines
- Existing Water Lines
- New Water Lines
- Water Line to Replace
- Excavation Pits
- Pipe Storage Area
- Existing Easement
- Curb Inlet
- Drop Inlet
- Slope Inlet
- Steam MH
- Potential Concern Point
- Fuel Tank
- Closed in Place Tank
- Removed Tank
- Comm- Coaxial
- Dominion Overhead Electric
- Overhead Electric
- Underground Electric
- Gas Line
- WW Line
- Steam Line
- Storm Ditch
- Storm Line
- Intermittent Stream
- Perennial Stream
- Potential Concern Area
- LUCA
- RPA
- Wetland
- Wetland: Jurisdictional
- Historic Structure
- Restricted-Archaeology Site

American Water Military  
Services Group (AW)  
Waterline Relocation -  
performed by others



KEY MAP



HDR Engineering, Inc.  
2600 Park Tower Drive, Suite 100  
Vienna, VA 22180-7342

FORT BELVOIR  
ISDC

FOR  
AMERICAN WATER OPERATIONS AND  
MAINTENANCE, INC.  
MILITARY SERVICES GROUP

Fitting ID	Type	Details	Northing	Easting
	TEE	12"x12"	11870677.37	6938284.76
	VALVE	12"	11870674.50	6938290.09
	TEE	10"x12"	11870906.47	6938379.00
	TEE	10"x10"	11870920.73	6938349.49
	VALVE	8"	11870903.23	6938376.66
	VALVE	12"	11870900.73	6938376.66
	VALVE	10"	11870925.66	6938351.68
	TEE	8"x6"	11870958.14	6938274.14
	VALVE	8"	11870958.90	6938270.32
	TEE	12"x12"	11870592.19	6938239.91
	VALVE	12"	11870587.60	6938245.95
	TEE	12"x4"	11870596.32	6938241.34
	VALVE	12"	11870587.26	6938237.02
	TEE	12"x8"	11870457.37	6938180.55
	VALVE	8"	11870457.79	6938174.74
	TEE	12"x4"	11870355.10	6938123.62
	VALVE	4"	11870356.86	6938118.61
	VALVE	12"	11870361.14	6938127.31
	TEE	8"x6"	11871151.12	6937836.09
	VALVE	6"	11871156.41	6937836.51
	VALVE	8"	11871152.21	6937830.63
	TEE	6"x4"	11871251.47	6937871.79
	BEND	4"	11871300.68	6937891.09
	VALVE	4"	11871254.03	6937867.80
	TEE	8"x6"	11870677.42	6937734.31
	VALVE	6"	11870683.25	6937737.23
	FIRE HYDRANT		11870688.61	6937739.18
	TEE	8"x6"	11870492.28	6938095.30
	VALVE	6"	11870488.87	6938093.35
	FIRE HYDRANT		11870484.01	6938092.86
	REDUCER	10"x8"	11870905.48	6938381.85
	REDUCER	10"x8"	11870923.82	6938344.36
	VALVE	4"	11871310.96	6937866.99
	REDUCER	6"x4"	11871257.92	6937874.28
	FIRE HYDRANT		11870585.22	6937906.35
	VALVE	6"	11870580.30	6937903.67
	TEE	8"x6"	11870575.38	6937901.43
	REDUCER	12"x10"	11870903.86	6938378.23
	TEE	6"x6"	11871113.66	6938338.30
	VALVE	6"	11870963.61	6938277.10
	VALVE	6"	11871117.64	6938331.05
	VALVE	4"	11870599.40	6938236.55

ISSUE	DATE	DESCRIPTION
4	7/26/2011	ISSUED FOR CONSTRUCTION
3	6/28/2011	100% DESIGN
2	6/21/2011	90% DESIGN
1	6/2/2011	60% DESIGN
PROJECT NUMBER 124114		
PROJECT MANAGER		KEN DEMMONS, PE
UTILITY DESIGNER		DAVID RIEDEL, EIT
QA/QC		CHAD JACOBS, PE

FT. BELVOIR  
CENTRAL POST

SCALE: 1" = 40'

CP-06

FILENAME: FtBelvoir-CP-02-11.mxd



**APPENDIX K**  
**Utility Rates Fort Belvoir**

FISCAL YEAR 11	GOVERNMENT RATE 'A'	NON-GOVERNMENT RATE 'B'	Notes
ELECTRIC (\$/KWHR)	\$0.09272	\$0.09562	Commodity & Maintenance
WATER (\$/KGal)	\$3.6300	\$4.6100	Commodity & Maintenance
SEWAGE (\$/KGal)	\$5.9000	\$7.5300	Commodity & Maintenance
NATURAL GAS (\$/Therm)	Gas Bill	Gas Bill	
LP GAS (\$/Gal) Contract	\$2.7500	\$2.8300	Contract Cost
# 2 FUEL OIL (\$/GAL) DESC	\$2.3000	\$2.6100	DESC Stock Fund Price Ground Fuels
STEAM (\$/KLB) 1422 Plant	\$12.0700	\$14.1800	Steam Plant O&M
REFUSE (\$/CUYD)	\$4.5800	\$4.7900	Collection & Disposal



## LEED for New Construction v2.2 Registered Project Checklist

Project Name: Army Fire Station

Project Address: FT. BELVOIR

Yes ? No

8	3	3	<b>Sustainable Sites</b>	14 Points
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Y			Prereq 1	<b>Construction Activity Pollution Prevention</b>	Required
1			Credit 1	<b>Site Selection</b>	1
1			Credit 2	<b>Development Density &amp; Community Connectivity</b>	1
		1	Credit 3	<b>Brownfield Redevelopment</b>	1
		1	Credit 4.1	<b>Alternative Transportation, Public Transportation Access</b>	1
1			Credit 4.2	<b>Alternative Transportation, Bicycle Storage &amp; Changing Rooms</b>	1
1			Credit 4.3	<b>Alternative Transportation, Low-Emitting &amp; Fuel-Efficient Vehicles</b>	1
		1	Credit 4.4	<b>Alternative Transportation, Parking Capacity</b>	1
	1		Credit 5.1	<b>Site Development, Protect or Restore Habitat</b>	1
1			Credit 5.2	<b>Site Development, Maximize Open Space</b>	1
1			Credit 6.1	<b>Stormwater Design, Quantity Control</b>	1
	1		Credit 6.2	<b>Stormwater Design, Quality Control</b>	1
	1		Credit 7.1	<b>Heat Island Effect, Non-Roof</b>	1
1			Credit 7.2	<b>Heat Island Effect, Roof</b>	1
1			Credit 8	<b>Light Pollution Reduction</b>	1

Yes ? No

3		2	<b>Water Efficiency</b>	5 Points
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1			Credit 1.1	<b>Water Efficient Landscaping, Reduce by 50%</b>	1
1			Credit 1.2	<b>Water Efficient Landscaping, No Potable Use or No Irrigation</b>	1
		1	Credit 2	<b>Innovative Wastewater Technologies</b>	1
1			Credit 3.1	<b>Water Use Reduction, 20% Reduction</b>	1
		1	Credit 3.2	<b>Water Use Reduction, 30% Reduction</b>	1

8	7	2	<b>Energy &amp; Atmosphere</b>	17 Points
---	---	---	--------------------------------	-----------

Y			Prereq 1	<b>Fundamental Commissioning of the Building Energy Systems</b>	Required
Y			Prereq 2	<b>Minimum Energy Performance</b>	Required
Y			Prereq 3	<b>Fundamental Refrigerant Management</b>	Required

\*Note for EA1: All LEED for New Construction projects registered after June 26<sup>th</sup>, 2007 are required to achieve at least two (2) points under EA1.

6	4		Credit 1	<b>Optimize Energy Performance</b>	1 to 10
				10.5% New Buildings or 3.5% Existing Building Renovations	1
				14% New Buildings or 7% Existing Building Renovations	2
				17.5% New Buildings or 10.5% Existing Building Renovations	3
				21% New Buildings or 14% Existing Building Renovations	4
				24.5% New Buildings or 17.5% Existing Building Renovations	5
				28% New Buildings or 21% Existing Building Renovations	6
				31.5% New Buildings or 24.5% Existing Building Renovations	7
				35% New Buildings or 28% Existing Building Renovations	8
				38.5% New Buildings or 31.5% Existing Building Renovations	9
				42% New Buildings or 35% Existing Building Renovations	10
	3		Credit 2	<b>On-Site Renewable Energy</b>	1 to 3
				2.5% Renewable Energy	1
				7.5% Renewable Energy	2
				12.5% Renewable Energy	3
		1	Credit 3	<b>Enhanced Commissioning</b>	1
1			Credit 4	<b>Enhanced Refrigerant Management</b>	1
1			Credit 5	<b>Measurement &amp; Verification</b>	1
		1	Credit 6	<b>Green Power</b>	1

continued...

Yes	?	No		
7	3	3	<b>Materials &amp; Resources</b>	13 Points

Y			Prereq 1	<b>Storage &amp; Collection of Recyclables</b>	Required
		1	Credit 1.1	<b>Building Reuse</b> , Maintain 75% of Existing Walls, Floors & Roof	1
		1	Credit 1.2	<b>Building Reuse</b> , Maintain 95% of Existing Walls, Floors & Roof	1
		1	Credit 1.3	<b>Building Reuse</b> , Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	<b>Construction Waste Management</b> , Divert 50% from Disposal	1
	1		Credit 2.2	<b>Construction Waste Management</b> , Divert 75% from Disposal	1
			Credit 3.1	<b>Materials Reuse</b> , 5%	1
	1		Credit 3.2	<b>Materials Reuse</b> , 10%	1
1			Credit 4.1	<b>Recycled Content</b> , 10% (post-consumer + ½ pre-consumer)	1
1			Credit 4.2	<b>Recycled Content</b> , 20% (post-consumer + ½ pre-consumer)	1
1			Credit 5.1	<b>Regional Materials</b> , 10% Extracted, Processed & Manufactured Region	1
1			Credit 5.2	<b>Regional Materials</b> , 20% Extracted, Processed & Manufactured Region	1
1			Credit 6	<b>Rapidly Renewable Materials</b>	1
1			Credit 7	<b>Certified Wood</b>	1

Yes	?	No		
12	3		<b>Indoor Environmental Quality</b>	15 Points

Y			Prereq 1	<b>Minimum IAQ Performance</b>	Required
Y			Prereq 2	<b>Environmental Tobacco Smoke (ETS) Control</b>	Required
1			Credit 1	<b>Outdoor Air Delivery Monitoring</b>	1
1			Credit 2	<b>Increased Ventilation</b>	1
1			Credit 3.1	<b>Construction IAQ Management Plan</b> , During Construction	1
1			Credit 3.2	<b>Construction IAQ Management Plan</b> , Before Occupancy	1
1			Credit 4.1	<b>Low-Emitting Materials</b> , Adhesives & Sealants	1
1			Credit 4.2	<b>Low-Emitting Materials</b> , Paints & Coatings	1
1			Credit 4.3	<b>Low-Emitting Materials</b> , Carpet Systems	1
1			Credit 4.4	<b>Low-Emitting Materials</b> , Composite Wood & Agrifiber Products	1
1			Credit 5	<b>Indoor Chemical &amp; Pollutant Source Control</b>	1
1			Credit 6.1	<b>Controllability of Systems</b> , Lighting	1
1			Credit 6.2	<b>Controllability of Systems</b> , Thermal Comfort	1
1			Credit 7.1	<b>Thermal Comfort</b> , Design	1
	1		Credit 7.2	<b>Thermal Comfort</b> , Verification	1
	1		Credit 8.1	<b>Daylight &amp; Views</b> , Daylight 75% of Spaces	1
	1		Credit 8.2	<b>Daylight &amp; Views</b> , Views for 90% of Spaces	1

Yes	?	No		
1	4		<b>Innovation &amp; Design Process</b>	5 Points

	1		Credit 1.1	<b>Innovation in Design</b> : Provide Specific Title	1
	1		Credit 1.2	<b>Innovation in Design</b> : Provide Specific Title	1
	1		Credit 1.3	<b>Innovation in Design</b> : Provide Specific Title	1
	1		Credit 1.4	<b>Innovation in Design</b> : Provide Specific Title	1
1			Credit 2	<b>LEED® Accredited Professional</b>	1

Yes	?	No		
39	20	10	<b>Project Totals (pre-certification estimates)</b>	69 Points

**Certified:** 26-32 points, **Silver:** 33-38 points, **Gold:** 39-51 points, **Platinum:** 52-69 points

# Owner's Project Requirements Document for LEED Fundamental Commissioning

Project:

REPLACE FIRE STATION

PN# 61453; FY 2009

FORT BELVOIR, VA

Approved: David L. Hale 4 May 09  
 Name Owner's Representative Date  
Raymond J. McNeil 04 May 09  
 Name Design Agent's Representative Date

## Overview and Instructions

The purpose of this document is to provide clear and concise documentation of the Owner's goals, expectations and requirements for commissioned systems, and shall be utilized throughout the project delivery and commissioning process to provide an informed baseline and focus for design development and for validating systems' energy and environmental performance.

The Owner's Project Requirements Document is a required document for LEED Version 2.2 EA Prerequisite 1, Fundamental Commissioning of the Building Energy Systems. It shall be completed by the Corps District/Design Agent based on coordination with the Installation/User/Proponent and shall be approved by the Installation/User/Proponent representative.

Use of this template is not required, nor are there any restrictions on editing of it. It is provided simply as a tool to assist project teams in meeting the documentation requirements for LEED Fundamental Commissioning.

The intent of the Owner's Project Requirements Document, per the LEED v2.2 Reference Guide, is to detail the functional requirements of a project and the expectations of the building's use and operation as it relates to commissioned systems. This template contains the basic recommended components indicated in the LEED v2.2 Reference Guide. It should be adapted as needed to suit the project, remaining reflective of the LEED intent.

## APPENDIX M

The Owner's Project Requirements Document should ideally be completed before the start of design and furnished to the design team. It must be completed prior to the approval of Contractor submittals of any commissioned equipment or systems to meet LEED requirements.

Updates to the Owner's Project Requirements Document throughout the course of project delivery shall be made by the Corps District/Design Agent based on decisions and agreements coordinated with and agreed to by the Installation/User/Proponent.

The Owner's Project Requirements Document shall be included in the project's LEED documentation file under EA PR1, Fundamental Commissioning of the Building Energy Systems.

## APPENDIX M

### Owner's Project Requirements Document for LEED Fundamental Commissioning Table of Contents

1. Owner and User Requirements
  - Primary Purpose, Program and Use
  - Project History
  - Broad Goals
2. Environmental and Sustainability Goals
  - Energy Efficiency Goals
  - General
  - Siting
  - Building Façade
  - Building Fenestration
  - Building Envelope
  - Roof
  - Other
3. Indoor Environmental Quality Requirements
  - Intended Use
  - Occupancy Schedule
  - Accommodations for After-Hours Use
  - Lighting, Temperature, Humidity, Air Quality, Ventilation, Filtration
  - Acoustics
  - Occupant Ability to Adjust System Controls
  - Types of Lighting
4. Equipment and Systems Expectations
  - Space Heating
  - Ventilation
  - Air Conditioning
  - Refrigeration
  - HVAC Controls
  - Domestic Hot Water
  - Lighting Controls
  - Daylighting Controls
  - Emergency Power
  - Other
5. Building Occupant and O&M Personnel Requirements
  - Facility Operation
  - EMCS
  - Occupant Training and Orientation
  - O&M Staff Training and Orientation

TABLE 1

14 Apr 09

## **1. Owner and User Requirements**

**What are the primary purpose, program and use of this project? (example: office building with data center)**

The primary purpose, program and use of this project will be a fire station.

**Describe pertinent project history. (example: standard design development)**

Built in 1934, Building 191 is a historic facility inadequate for the provision of fire protection for training, research and development, family housing and administrative buildings located on South Post. The existing apparatus bays are too small to accommodate modern firefighting equipment. Replacement fire engines must be modified (shortened) to allow them to fit into the bays. Apparatus and building damages routinely occur due to engine width. There is no circulation room around the vehicles. The existing facility is inadequate in size, configuration, and condition.

### **Broad Goals**

**What are the broad goals relative to program needs?**

Sustainable Goals: The fire station has potential to reach gold rating but minimum LEED silver is required. Also the project must meet the requirements of EPACT05.

**What are the broad goals relative to future expansion?**

Due to space limitations with land at the installation - the board goals relative to future expansion would be to build a brand New facility to fully accommodate needs for a much larger fire station.

**What are the broad goals relative to flexibility?**

The broad goals relative to flexibility is to alternate staffing in shifts; that way we can accommodate sleeping arrangement in the dorm rooms. Also our Day Room will be a dual function as a training room.

**What are the broad goals relative to quality of materials?**

The broad goals for the quality of materials is to incorporate sustainable products to the maximum extent possible. Type 5 construction or better is expected.

**What are the broad goals relative to construction costs?**

The broad goals relative to construction cost is build within the restraints of the Project Amount on the DD1391

**What are the broad goals relative to operational costs?**

The goals for operational cost is to do what is necessary in the most conservative fashion to operate the facility 24 hours a day – 7 days a week.

**What are the broad goals relative to life cycle of the equipment?**

Goals relative to life cycle of equipment is acquired and maintain equipment to maximum life and serve its useful purpose.



14 Apr 09

Other broad goals: Maintain update modern equipment to better serve the community and installation

## **2. Environmental and Sustainability Goals**

**What are the project goals relative to sustainability and environmental issues? (example: LEED Silver rating)**

LEED SILVER is our main objective.

**What are the project goals relative to energy efficiency? (example: Meet EPACT)**

Meet requirements of EPACT 05

**What are the project goals and requirements for building siting that will impact energy use?**

Orientation of the facility which takes advantage of natural sunlight and prevailing winds which ultimately effects energy use.

**What are the project goals and requirements for building facade that will impact energy use?**

The building Façade must blend in with its overall look of the base and further compliment other building near by.

**What are the project goals and requirements for building fenestration that will impact energy use?**

Window Fenestration should take advantage of sunlight to maximum extent possible

**What are the project goals and requirements for building envelope that will impact energy use?**

The building envelope should be constructed and designed to save energy.

**What are the project goals and requirements for building roof that will impact energy use?**

The roof material must meet Base Installation Design Guide – IDG

Other: *(Insert as applicable)*

Not applicable.

## **3. Indoor Environmental Quality Requirements**

**What is the intended use for all spaces? For all spaces that have an intended use that is not readily apparent from the space name, provide this information in Table 1.**

Fire Station – See Table 1

**What is the anticipated occupancy schedule (numbers of occupants and time frames) for all occupied spaces? Indicate the default occupancy schedule below and for all spaces that have an occupancy schedule that differs from the default, provide this information in Table 1.**

This is a 24 Hr facility. Minimum staffing will be 10 personnel. Maximum staffing will be 11 personnel. Due to the nature of our occupation it is not possible to clearly identify specific timeframes that any of the spaces identified in Table 1 will be used and or not used. It is to be assumed that any spaces identified in Table 1 may be required to be functional 24 hours per day

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**What accommodations for after-hours use are required? (example: access control, lighting controls, HVAC controls) Indicate general accommodations required below and for all spaces that have special requirements, provide this information in Table 1.**

Fort Belvoir Directorate of Emergency Service will operate the facility 24/7 to provide Fire and Emergency services to the Installation.

**What are the lighting, temperature, humidity, air quality, and ventilation and filtration requirements for all spaces? Indicate the default requirements below and for all spaces that have a requirement that differs from the default, provide this information in Table 1. (BOTH MECH. and ELECTRICAL response required from DPW Engineering Division)**

Lighting: Follow IES recommended lighting level and use energy efficient product meeting Energy Star requirements \_\_\_\_\_

Temperature: Indoor Condition a. Summer 75 F degree Dry bulb, Winter 70 F degree Dry bulb

Humidity: Indoor Condition Summer 50% relative humidity, Winter 20% Min. relative humidity

Air Quality: ASHRAE standards 62-10-2004 Ventilation for acceptance indoor air quality

Ventilation: 20CFM/Person

Filtration: High/ Medium efficiency filters

**What are the acoustical requirements for all spaces? Indicate the default acoustical requirements below and for all spaces that have a requirement that differs from the default, provide this information in Table 1. (MECH. response required DPW Engineering Division)**

Based on ASHRAE Fundamental (2005) chapter -7 NC-35 level or less in octave band range between 250 thru 2000 octave frequencies range.

**What is the desired level of occupant ability to adjust systems controls? Indicate the default desired levels below and for all spaces that have a desired level that differs from the default, provide this information in Table 1. (BOTH MECH. and ELECTRICAL response required DPW Engineering Division.)**

Lighting: Provide light switches, bi-level lighting control, occupancy sensors, dimmer, etc. \_\_\_\_

Temperature: Room Thermostat

Humidity: N/A

Air Quality: Carbon Dioxide sensor

Ventilation: \_\_\_\_\_

**What, if any, specific types of lighting are desired? (example: fluorescent in 2x2 grid, accent lighting, particular lamps) (ELECTRICAL response required DPW Engineering Division.)**

Energy efficient Lighting System namely Fluorescent T-8 electronic ballast with individual space controls.

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#### 4. Equipment and System Expectations

(Complete for each category as applicable or indicate "none identified" or "N/A". Add desired features information for other anticipated commissioned systems as applicable) **(MECHANICAL response required DPW Engineering Division.)**

Indicate desired features for the following commissioned system: Space Heating

Desired Type: Ground Source Heat Pumps (GSHP) w/ VFD drives on motors, fans and  
Pumping systems

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: EER rating to be 14.1 or more, COP rating to be 3.3 or more

Desired Technologies: Renewable Energy Sources

Indicate desired features for the following commissioned system: Ventilation

Desired Type: Separate system to control humidity during GSHP off conditions

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: \_\_\_\_\_

Desired Technologies: \_\_\_\_\_

Indicate desired features for the following commissioned system: Air Conditioning

Desired Type: Ground Source Heat Pumps (GSHP) w/ VFD drives on motors, fans and  
pumping systems

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: EER rating to be 14.1 or more, COP rating to be 3.3 or more

Desired Technologies: Ground Source Heat Pump (GSHP)

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Indicate desired features for the following commissioned system: Refrigeration

Desired Type: \_\_\_\_\_

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: \_\_\_\_\_

Desired Technologies: \_\_\_\_\_

Indicate desired features for the following commissioned system: HVAC Controls

Desired Type: Direct Digital Controls system ( DDC) for HVAC

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: \_\_\_\_\_

Desired Technologies: \_\_\_\_\_

Indicate desired features for the following commissioned system: Domestic Hot Water

Desired Type: Solar Hot Water Heating with elect heat back up

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: \_\_\_\_\_

Desired Technologies: Renewable energy sources

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**Indicate desired features for the following commissioned system: Lighting Controls  
(ELECTRICAL response required DPW Engineering Division.)**

Desired Type: Individual space lighting controls, and other controls to reduce energy use  
(e.g., dimmers, occupancy sensors, etc.)

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: \_\_\_\_\_

Desired Technologies: Energy Efficient Technologies

**Indicate desired features for the following commissioned system: Daylighting Controls  
(MECHANICAL response required DPW Engineering Division.)**

Desired Type: Automatic daylighting control with bi-level and/or dimmable lighting system \_\_\_\_

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: \_\_\_\_\_

Desired Technologies: \_\_\_\_\_

**Indicate desired features for the following commissioned system: Emergency Power (ELECTRICAL  
response required DPW Engineering Division.)**

Desired Type: Automatic Engine starting with loss of normal power, gas type with exhaust manifold, automatic transfer switch with electronic control and display, all in weather proof outdoor single package mount on vibration proof damper. Provide low emission, low noise, and high efficiency type.

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

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Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: \_\_\_\_\_

Desired Technologies: \_\_\_\_\_

Indicate desired features for the following commissioned system: Other - \_\_\_\_\_

Desired Type: \_\_\_\_\_

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: \_\_\_\_\_

Desired Technologies: \_\_\_\_\_

### **5. Building Occupant and O&M Personnel Requirements**

**How will the facility be operated? Who will operate the facility?**

Fort Belvoir Directorate of Emergency Service will operate the facility 24/7 to provide Fire and Emergency services to the Installation.

**Will the facility be connected to an EMCS? If so, what are the interface requirements? (example: monitoring points, control points, scheduling)**

The fire station will not be connected to the site's EMCS.

**What is the desired level of training and orientation for building occupants to understand and use the building systems?**

High level of training and orientation for Fire and Emergency Services staff to understand and properly operate the building system's are required if and only if it is specialized equipment. Otherwise a low level of training would be sufficient.

**What is the desired level of training and orientation for O&M staff to understand and maintain the building systems?**

8 hour of minimum training to O & M staff

High level of training and orientation for O&M staffs to understand and maintain the building system is required if and only if it is specialized equipment. Otherwise a low level of train would be sufficed.

Table 1(MECH. and ELECTRICAL response required from DPW Engineering Division)

Space	Use / Activity	Num of Occs	Special Occupancy Schedule	After Hours Use Reqmt.	Special Cooling Reqmt.	Special Heating Reqmt.	Special Humidity Reqmt.	Special Ventil./Filtration Reqmt.	Special Acoustic Reqmt.	Special Lighting Reqmt.	Special Occup Adjustability Reqmt.
STATION OFFICE/WATCH DESK	OFFICE SPACE	3									
COMPUTER TRAINING RM	TRAINING	4									
DAY ROOM	LEISURE AND TRAINING	10									
FITNESS RM	EXERCISE	8									
DORM RMS	SLEEPING	10									
STORAGE	PAPER; SUPPLIES, ETC.	0									
RECYCLE RM	RECYCLE PLASTIC; PAPER; ALUM.	0	None	None	None	None	None	None	None	None	None
LAUNDRY RM	LAUNDRY	1									
MECH/ELECT/ COMM RM	BUILDING SERVICE AREA	0									
SCBA/ COMPR RM/ MAINT.	EQUIPMENT	2									
WORK ROOM EQUIPMENT	EQUIPMENT	4									
RESTROOMS	TOILET/ SHOWERS	4									
APPARATUS BAY	FIRE TRUCK STORAGE	10									

APPENDIX N  
LEED Requirements for Multiple Contractor Combined Projects

Not Used



APPENDIX O  
LEED Strategy Tables

Not Used

## APPENDIX P

### LEED Registration of Army Projects

15 April 2010

#### **Number of Registrations**

Each building must be registered separately, except multiple instances of a standard building on a shared site may be registered as a single project. If a single registration for multiple buildings is chosen, all buildings under the single registration must earn exactly the same points. Do not register buildings that are exempt from a specific LEED achievement requirement.

#### **Typical Registration Procedure**

1. Login, complete the online registration form (see guidance below) at the GBCI LEED Online website <http://www.gbci.org/DisplayPage.aspx?CMSPageID=174> and submit it online.
2. Pay the registration fee via credit card (USACE staff: credit card PR&C is funded by project design or S&A funds).
3. GBCI will follow up with a final invoice, the LEED-online passwords and template information.
4. The individual who registers the project online is, by default, the Project Administrator.

#### **Completing the Registration Form**

##### **BEFORE YOU BEGIN:**

**Create a personal account with USGBC if you do not have one.**

**You will need the following information:**

**Project name as it appears in P2 (obtain from USACE Project Manager)**

**Building number/physical address of project**

**Zip code for Installation/project location**

**Anticipated construction start and end dates**

**Total gross area all non-exempt buildings in registration**

**Total construction cost all non-exempt buildings only (see Project Details Section instructions below)**

##### **ACCOUNT/LOGIN INFORMATION**

1. The person registering the project **must have an account with USGBC** (login and password) to complete the form. Go to <http://www.gbci.org/>, click on "register a project" at the drop-down menu for project certification (at the top of the page) and select "register now for LEED 2009" to start the project registration process. If you have an account, login with your email address and password and select "register new project" to proceed. If you do not have an account, you may select "register a new account" and follow the instructions. It is recommended that you create an account separately on the USGBC website before you start the form. IMPORTANT: USACE team members are members of USGBC and are eligible for Member prices. USACE team members registering projects should be sure to include the USACE Corporate Access ID in their personal account profile (if you do not have it contact [richard.l.schneider@usace.army.mil](mailto:richard.l.schneider@usace.army.mil) or [judith.f.milton@usace.army.mil](mailto:judith.f.milton@usace.army.mil) for the number).
2. The Account/Login Information section is filled out by the person registering the project. It may be a Contractor or a USACE staff member.

##### **ELIGIBILITY SECTION**

Follow directions (accepting the terms and conditions)

Review your profile information and make corrections if needed

##### **RATING SYSTEM SELECTION SECTION**

Select single project registration and I know which rating system.

Select the rating system - currently only LEED-NC and LEED for Homes are approved for Army use without special approval.

LEED Minimum Program Requirements: select YES

**RATING SYSTEM RESULTS SECTION**

Confirm selected rating system.

**PROJECT INFORMATION SECTION**

**Project Title:** Begin the project title with a one-word identifier for the Installation. Do not include the word "Fort". After this match the project name used in P2 (contact the USACE Project Manager for this information) and identify the building being registered. Example: "Stewart 4<sup>th</sup> IBC - DFAC".

**Project Address 1 and 2:** This is the physical location of the project. Provide building number, street address, block number or whatever is known to best describe the location of the project on the Installation.

**Project City:** Installation Name

**State, Country, Zip Code:** Self-explanatory

**Anticipated Construction Start and End Dates:** Self-explanatory – give your best guess if unknown. Note that required data entry format is: 1 or 2 digit month/1 or 2 digit date/4 digit year (example 3/23/2010)

**Gross Square Footage:** Provide total area all buildings in LEED project. Exclude the area of any buildings that are exempt from the LEED achievement requirement (for example, exclude an unconditioned storage shed to be constructed with a barracks complex).

**Is Project Confidential:** Indicate NO except, if project has security sensitivity (elements that are FOUO or higher security), indicate YES.

**Notification of Local Chapter:** Indicate NO unless Government/USACE Project Manager requests you to indicate YES.

**Anticipated Project Type:** Select the most appropriate option from the drop-down menu.

**Anticipated Certification Level:** Select the applicable option from the drop-down menu (Silver is the usual level).

**PROJECT OWNER INFORMATION SECTION**

**Project Owner First Name, Last Name, email, phone, address:** The Project Owner is the USACE Project Manager. Obtain this info from the USACE Project Manager.

**Organization:** U.S. Army Corps of Engineers. This field MUST be completed this way because it will be used as a search field by higher HQ to find all USACE registered projects. You may supplement it with district name at the end but DO NOT revise or use an acronym.

**May we publish Owner information:** Indicate NO

**Owner Type:** Pick Federal Government from drop-down menu.

**Project Owner Assertion:** Check the box

**PAYMENT INFORMATION**

Self-explanatory

**APPENDIX Q**  
**REV 2.1 – 30 SEP 2010**  
**AREA COMPUTATIONS**

**Computation of Areas:** Compute the “gross area” and “net area” of facilities (excluding family housing) in accordance with the following subparagraphs:

**(1) Enclosed Spaces:** The “gross area” is the sum of all floor spaces with an average clear height  $\geq 6'-11"$  (as measured to the underside of the structural system) and having perimeter walls which are  $\geq 4'-11"$ . The area is calculated by measuring to the exterior dimensions of surfaces and walls.

**(2) Half-Scope Spaces:** Areas of the following spaces shall count as one-half scope when calculating “gross area”:

- Balconies
- Porches
- Covered exterior loading platforms or facilities
- **Covered but not enclosed spaces, canopies, training, and assembly areas**
- Covered but not enclosed passageways and walks
- Open stairways (both covered and uncovered)
- Covered ramps
- Interior corridors (Unaccompanied Enlisted Personnel Housing Only)

**(3) Excluded Spaces:** The following spaces shall be excluded from the “gross area” calculation:

- Crawl spaces
- Uncovered exterior loading platforms or facilities
- Exterior insulation applied to existing buildings
- Open courtyards
- Open paved terraces
- Uncovered ramps
- Uncovered stoops
- Utility tunnels and raceways
- Roof overhangs and soffits measuring less than 3'-0" from the exterior face of the building to the fascia

**(4) Net Floor Area:** Where required, “net area” is calculated by measuring the inside clear dimensions from the finish surfaces of walls. If required, overall “assignable net area” is determined by subtracting the following spaces from the “gross area”:

- Basements not suited as office, special mechanical, or storage space
- Elevator shafts and machinery space
- Exterior walls
- Interior partitions
- Mechanical equipment and water supply equipment space
- Permanent corridors and hallways
- Stairs and stair towers
- Janitor closets
- Electrical equipment space
- Electronic/communications equipment space

RMS SUBMITTAL REGISTER INPUT FORM			CONTRACT NUMBER		PAGE		REVIEW ORDER																		
TITLE AND LOCATION																									
Sattelite Fire Station, Fort Belvoir, Virginia, PN 61453																									
Button	<-----Right click for Instructions		TYPE OF SUBMITTAL								CLASSIFICATION				REVIEWING OFFICE										
SECTION	PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	01 - PRECON SUBMITTALS	02 - SHOP DRAWINGS	03 - PRODUCT DATA	04 - SAMPLES	05 - DESIGN DATA	06 - TEST REPORTS	07 - CERTIFICATES	08 - MFRS INSTRUCTIONS	09 - MFRS FIELD REPORT	10 - O&M DATA	11 - CLOSEOUT SUBMITTALS	FIO - FOR INFORMATION ONLY	GA - GOVERNMENT APPROVED	DA - DESIGNER OF RECORD APPROVAL	CR - CONFORMANCE REVIEW	DA / CR	DA / GA	DO - DISTRICT OFFICE	AO - AREA OFFICE	RO - RESIDENT OFFICE	PO - PROJECT OFFICE	DR - DESIGNER OF RECORD	AE - ARCHITECT / ENGINEER
00 72 00	52.236-13	Accident Prevention Plan	X													X				X					
00 73 00	1.11	Dev. From Accept. Design. No Deviation from Contract					X										X			X			X		
00 73 00	1.11	Dev. From Accepted Design - Deviates from Contract					X											X		X			X		
00 73 00	1.17	Supplemental Price Breakdown	X											X						X					
00 73 00	1.18	SSHO Qualifications	X											X						X					
01 10 00	5.2.3.1	(if concrete pavement) Joint Layout Plan with design drawings					X									X									
01 10 00	5.5.2	Building Envelope Sealing Performance Testing						X						X						X					
01 10 10	***	Tests as Reg by Codes - DOR Develops Test Program						X						X						X			X		
01 10 00	5.8.3	BAS Review Information		X													X		X	X			X		
01 10 00	5.8.3	BAS Performance Verification Test						X						X					X	X			X		
01 10 00	5.8.4	Testing Adjusting and Balancing						X						X					X	X			X		
01 10 00	5.8.5	Commissioning						X						X					X	X			X		
01 10 00	6.15	Environmental As Required for Site Specific					X									X			X	X			X		
01 10 00	6.16	Permits as required for Site specific					X									X			X	X			X		
01 10 00	5.10.2	Fire Protection Tests						X	X					X					X	X			X		
01 32 01.00 10	3.4.1	Preliminary Project Schedule	X												X					X					
01 32 01.00 10	3.4.2	Initial Project Schedule	X												X					X					
01 32 01.00 10	3.4.3	Design Package Schedule	X												X					X					
01 32 01.00 10	3.6.1	Periodic schedule updates from the Contractor	X												X					X					
01 32 01.00 10	3.7	Time Extension Request (Schedule)	X												X					X					
01 33 00	1.8	Submittal Register - DOR Input Required	X												X					X			X		
01 33 00	1.8	Submittal Register Updates (Design Packages, etc.)	X												X					X			X		
01 33 00	1.3.1	Substitution of Manuf or Model Named in Proposal		X	X												X			X			X		
01 33 16	1.2	Identify Designer(s) of Record	X												X					X					
01 33 16	1.1.2 / 3.2.4	Fast Track Design Package(s)					X									X			X	X					
01 33 16	1.2	Identification of all Designers of Record	X													X				X					
01 33 16	3.2.1	Site and Utility Des Package, incl. Substantiation					X									X			X	X					
01 33 16	3.2.2/3.5	Interim Des Subm Package(s), incl. Substantiation					X									X			X	X					
01 33 16	3.5.1	Drawings					X									X			X	X					
01 33 16	3.5.2.2	Sitework Design Analyses					X									X			X	X					
01 33 16	3.5.2.3	Structural Design Analyses					X									X			X	X					
01 33 16	3.5.2.4	Security Design Analyses					X									X			X	X					
01 33 16	3.5.2.5	Architectural Design Analyses					X									X			X	X					
01 33 16	3.5.2.6	Mechanical Design Analyses					X									X			X	X					
01 33 16	3.5.2.7	Life Safety Design Analyses					X									X			X	X					
01 33 16	3.5.2.8	Plumbing Design Analyses					X									X			X	X					
01 33 16	3.5.2.9	Elevator Design Analyses (as Applicable)					X									X			X	X					
01 33 16	3.5.2.10	Electrical Design Analyses					X									X			X	X					
01 33 16	3.5.2.11	Telecommunications Design Analyses					X									X			X	X					
01 33 16	3.5.2.12	Cathodic Protection Design Analyses					X									X			X	X					
01 33 16	3.5.3	Geotechnical Investigations and Reports					X									X			X	X					
01 33 16	3.5.4	LEED Submittals					X									X			X	X					
01 33 16	3.5.5	Energy Conservation Documentation					X									X			X	X					
01 33 16	3.5.6	Specifications					X									X			X	X					
01 33 16	3.5.7	Building Rendering					X									X			X	X					
01 33 16	3.2.4/3.7	Final Des Submittal Package(s), incl. Substantiation					X									X			X	X					
01 33 16	3.7.5	DD Form 1354 (Transfer of Real Property)										X				X			X	X					
01 33 16	3.7	Independent Technical Review					X									X			X	X					
01 33 16	3.2.5/3.8	Design Complete Submittal Package(s)					X									X			X	X					
01 33 16	3.3.3	Design and Code Review Checklists					X									X			X	X					
01 33 16	A-2.0	SID - Interim and Final (as applicable)			X	X									X				X	X					
01 33 16	B-2.0	FFE (as Applicable)					X								X				X	X					
01 33 16	F-3.1.3	BIM Model and data					X									X			X	X					
01 45 04.00 10	3.2	Design and Construction QC Plan	X													X			X	X					
01 57 20.00 10	1.2	Environmental Protection Plan	X													X			X	X					
01 78 02.00 10	1.2.1	Final as-Built Drawings/ BIM Model											X		X					X					
01 78 02.00 10	1.2.3.11	Non-Hazardous Solid Waste Diversion Reports							X					X						X					
01 78 02.00 10	1.2.7	Provide final as-built CADD and BIM Model files											X		X					X					
01 78 02.00 10	1.2.9	Provide scans of all other docs in Adobe.pdf format											X		X					X					
01 78 02.00 10	1.3.1	Equip-in-Place list of all installed equip and cost											X		X					X					
01 78 02.00 10	1.3.2	Data on equip not addressed in O&M manuals											X		X					X					
01 78 02.00 10	1.3.3	Final as-built specs - electronic files											X		X					X					
01 78 02.00 10	1.4.2.1	Warranty management plan - FAR 52.246-21											X		X					X					
01 78 02.00 10	1.4.2.1	Certificates of Warranty for extended warranty items											X		X					X					
01 78 02.00 10	1.4.2.1	Contractor's POCs for implementing warranty process											X		X					X					
01 78 02.00 10	1.4.2.1	List of each warranted equip, item, feature or system											X		X					X					
01 78 02.00 10	1.5	See also Section 01 10 00 par. 5.8.4 and 5.8.5											X		X					X					
01 78 02.00 10	1.6.1.2	Equipment O&M Manuals - 1 electronic / 2 hard copies											X		X					X					
01 78 02.00 10	1.7	Field Training DVD Videos										X		X						X					
01 78 02.00 10	1.8	Pricing of CF/CI and GF/CI Property											X		X					X					
01 78 02.00 10	1.11	List of Completed Cleanup Items											X						X	X					
01 78 02.00 10	1.12	Interim Form DD 1354											X						X	X					
Appendix T	A. 1	Life Cycle Analysis for Light Level Tuning					X									X			X	X					
Appendix T	A. 4	Lif Cycle Analysis Automated Sahing.					X									X			X	X					
Appendix T	B.1.	Qualifications of Testing Agent						X								X			X	X					
Appendix T	B. 1.	Functional area Lighting Control Tests						X								X			X	X					

**Appendix S****REV 1.1 JUL 2011.****Manufacturing Performance Requirements for Plumbing Fixtures From  
The Energy Policy Act of 1992 (PL 102-486)  
(Including Exceptions for Projects Registered for LEED 3.0 or higher)**

**Note:** This information is for use in establishing the Baseline to calculate flow rate reductions from said Baseline, where required by the contract.

**Subtitle C--Appliance and Equipment Energy Efficiency Standards****SEC. 123. ENERGY CONSERVATION REQUIREMENTS FOR CERTAIN LAMPS AND PLUMBING PRODUCTS.**

... (j) **STANDARDS FOR SHOWERHEADS AND FAUCETS-** (1) The maximum water use allowed for any showerhead manufactured after January 1, 1994, is 2.5 gallons per minute when measured at a flowing water pressure of 80 pounds per square inch. Any such showerhead shall also meet the requirements of ASME/ANSI A112.18.1M-1989, 7.4.3(a).

`(2) The maximum water use allowed for any of the following faucets manufactured after January 1, 1994, when measured at a flowing water pressure of 80 pounds per square inch, is as follows:

`Lavatory faucets: 2.5 gallons per minute **(BUT SEE BELOW\*\*)**

`Lavatory replacement aerators: 2.5 gallons per minute

`Kitchen faucets : 2.5 gallons per minute

`Kitchen replacement aerators: 2.5 gallons per minute

`Metering faucets: 0.25 gallons per cycle

`(k) **STANDARDS FOR WATER CLOSETS AND URINALS-** (1)(A) Except as provided in subparagraph (B), the maximum water use allowed in gallons per flush for any of the following water closets manufactured after January 1, 1994, is the following:

`Gravity tank-type toilets --1.6 gpf.

`Flushometer tank toilets --1.6 gpf.

`Electromechanical hydraulic toilets --1.6 gpf.

`Blowout toilets --3.5 gpf.

`(B) The maximum water use allowed for any gravity tank-type white 2-piece toilet which bears an adhesive label conspicuous upon installation consisting of the words `Commercial Use Only' manufactured after January 1, 1994, and before January 1, 1997, is 3.5 gallons per flush.

`(C) The maximum water use allowed for flushometer valve toilets, other than blowout toilets, manufactured after January 1, 1997, is 1.6 gallons per flush.

`(2) The maximum water use allowed for any urinal manufactured after January 1, 1994, is 1.0 gallon per flush.

**\*\* EXCEPTIONS for Projects Registered under LEED 3.0 or higher.**

1. Any exceptions identified in the applicable LEED criteria.
2. Public lavatory faucets shall deliver a maximum flow rate of 0.5 gallons per minute, when tested in accordance with ASME A 112.18/CSA B125. Use that flow rate as the Baseline figure for calculating any required reductions from the Baseline.

## APPENDIX T

### FUNCTIONAL AREA LIGHTING CONTROL STRATEGY (FALCS)

#### A. GENERAL LIGHTING CONTROL SYSTEM ENERGY MANAGEMENT STRATEGIES

**SUMMARY:** This appendix describes various lighting energy management strategies to utilize across functional areas. These strategies are intended to supplement and NOT supersede the requirements of ASHRAE 90.1.

1. Consider **LIGHT LEVEL TUNING** to maintain the appropriate light level for a given space. Initial light levels are set high to compensate for light depreciation over time. Where dimming ballasts or dimmable LED drivers are used, they shall be digital and addressable in nature (where available) that can provide individual fixture light level tuning and reconfigurability that dims the light level to the target level, saving the energy that otherwise would be used to compensate for future light depreciation. Provide a life-cycle cost-benefit analysis (LCCBA) of light level tuning for all spaces where the general lighting luminaires are equipped with digital addressable dimming ballasts or LED drivers. The LCCBA shall follow the methodology contained in the IESNA Lighting Handbook. Provide light level tuning where the LCCBA shows it to be economical.
2. Use **OCCUPANCY/VACANCY SENSORS** to automatically turn off lighting a specified time after all occupants leave the space. The off time shall be adjustable settable to 1, 5, 15, or 30 minutes. Select the type (single or dual technology, wired or wireless) based on the use and configuration of the space. Lighting control system shall have the capability to manage both hard-wired and wireless sensors where applicable. Single technology solutions shall incorporate signal processing technology that distinguishes between background noise and actual motion without automatically changing their sensitivity threshold. To maximize energy savings potential, all occupancy sensors shall be either **MANUAL ON – AUTOMATIC OFF** (vacancy sensor) or **AUTOMATIC ON** (to a specified light level of 50% or less) – **AUTOMATIC OFF** to maximize energy savings. Occupancy/Vacancy sensors properly located in the space and set appropriately can offer typical lighting energy savings of 15% or more.
3. Use **DAYLIGHT HARVESTING** to control lighting in areas within at least two window head heights (head height is the distance from the floor to the top of the glazing) adjacent to exterior view windows. Typical daylight penetrates three times the window head height into the space. To maximize energy savings, daylight dimming strategies need to penetrate beyond the first row of luminaires (first daylight zone). When daylighting installed fluorescent or LED luminaires, accomplish daylight harvesting by digitally addressable dimming ballasts or drivers. As the natural light in the space increases, the artificial light level should dim gradually to maintain a uniform light level and prevent disruption to the occupants. One daylight sensor must be able to control multiple daylighting zones (cross-zoning) without the need of adding more sensors. All controls (daylight sensors, occupancy sensors, wall stations) shall have the capability to connect to the system via hard wire or wireless. Apply the same daylighting strategies to areas where skylights are available (refer to ASHRAE 189.1 daylight zone definitions). Daylighting systems properly tuned and calibrated can offer typical lighting energy savings of 15% or more.
4. Consider **AUTOMATED SHADING** in spaces utilizing daylight harvesting to maximize the energy savings of the day lighting system. The shades shall be controlled to reduce glare and unwanted heat gain while still allowing natural light to enter the space. When utilizing automated shading consider the following :
  - A. For ease of use and space aesthetics, operate the automated shades by common controls, wired or wireless (i.e. same appearance and design) with the lighting control system.
  - B. For maximum energy savings the automated shading system shall predictably position the shades based on a combination of time of day, façade direction, and sky conditions.
  - C. For maximum design flexibility and ease of installation, shade system should have the capability to address and control each shade individually.
  - D. The shading system shall have a manual override that allows the occupant to temporarily adjust the shades to any desired position. The system will revert back to automatic control after a specified period of time.

Provide a life-cycle cost-benefit analysis (LCCBA) of automated shading for all spaces where daylight harvesting is provided. The LCCBA shall follow the methodology contained in the IESNA Lighting Handbook. Provide automated shading where the LCCBA shows it to be economical.



5. Use SCENE BASED DIMMING in multiple-use areas including auditoriums, conference rooms and classrooms. Also provide scene based dimming in dining rooms and gymnasiums with multiple functions. One button preset touch recall shall allow multiple zones of light within a space to go to the appropriate light levels, known as a scene, for a specific task or use. Scene based control shall allow the integration of AV controls, shading/projection screens and lighting to work seamlessly with one button preset touch (i.e. lights dim, projection screen lowers, and shades go down). If dimming ballasts or LED drivers are used, they shall also be digital and addressable in nature (where available) to take advantage of installation and life-cycle reconfiguration benefits.
6. Provide PERSONAL CONTROL of lighting in spaces to allow the user of the space to vary the general light level based on the task at hand. Personal control can be achieved by wall mounted controls (hard wired or wireless), Infrared or Radio Frequency (RF) wireless devices, or via computer. Digital addressable ballasts and LED drivers allow the control flexibility of personal dimming of installed lighting on the occupant's work area (i.e. dim the luminaire over their cubicle to the appropriate light level).
7. Consider WIRELESS lighting control options for all installations, including retrofit projects (easy installation, lower installed cost, no power packs necessary). Wireless products shall include but not be limited to occupancy / vacancy sensors, daylight sensors, local wall controls, plug in switching and dimming appliance and parasitic load modules. To avoid interference, wireless products should communicate in an FCC frequency band that does not allow continuous transmissions and is free of Wi-Fi devices.

## **B. FUNCTIONAL TESTING AND MANUFACTURER SUPPORT**

SUMMARY: This section describes functional testing to be performed on the lighting control system and the support required from the lighting control manufacturer.

1. Hire an independent agent with no less than three years experience in testing of complex lighting control systems to conduct and certify functional testing of lighting control devices and control systems. The testing agent shall not be directly involved in either the design or construction of the project and shall certify the installed lighting controls meet or exceed all requirements of ASHRAE 90.1 and all documented performance criteria. The lighting control manufacturer's authorized technical representative may serve as the testing agent. Submit qualifications of the testing agent for approval. Submit copies of test results to the Government.
2. LIGHTING CONTROL MANUFACTURER SUPPORT shall include technical phone support located in the United States. The technical phone support shall be available 24 hours a day, 365 days a year.

14

**MCV Associates, Inc.**

4605-C Pinecrest Office Park Dr  
Alexandria, VA 22312  
703-914-4850

File Name : Gunston Rd 16th St

Site Code : 00000096

Start Date : 5/22/2008

Page No : 1

**Groups Printed- Unshifted - Bank 1**

Start Time	Gunston Rd From North				16th St From East				Gunston Rd From South				16th St From West				Exclu. Total	Inclu. Total	Int. Total
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds			
07:00 AM	10	33	3	0	0	3	0	0	0	4	0	0	1	0	0	0	0	54	54
07:15 AM	9	68	4	0	0	2	12	3	0	21	3	3	4	5	3	0	6	131	137
07:30 AM	16	78	7	0	0	2	6	3	0	10	2	3	8	5	0	0	6	134	140
07:45 AM	12	43	5	0	0	7	7	0	1	12	0	0	1	4	2	0	0	94	94
Total	47	222	19	0	0	14	25	6	1	47	5	6	14	14	5	0	12	413	425
08:00 AM	18	77	11	0	0	5	9	4	1	23	1	2	8	4	1	0	6	158	164
08:15 AM	15	44	19	0	1	6	7	0	5	23	0	0	5	5	1	0	0	131	131
08:30 AM	20	44	12	0	2	7	15	1	1	24	1	0	9	8	1	0	1	144	145
08:45 AM	10	58	6	0	1	4	11	1	0	17	0	0	10	9	2	0	1	128	129
Total	63	223	48	0	4	22	42	6	7	87	2	2	32	26	5	0	8	561	569
*** BREAK ***																			
11:00 AM	10	46	3	0	7	2	15	1	1	47	1	0	6	1	0	0	1	139	140
11:15 AM	5	39	3	0	5	1	21	0	0	74	4	0	2	3	1	0	0	158	158
11:30 AM	10	51	0	0	5	1	20	0	9	74	8	0	3	0	0	0	0	181	181
11:45 AM	20	47	1	0	4	1	15	0	0	64	3	0	0	1	0	0	0	158	158
Total	45	183	7	0	21	5	71	1	10	259	16	0	11	5	1	0	1	634	635
12:00 PM	9	39	8	0	1	4	12	0	1	52	3	0	14	10	1	0	0	154	154
12:15 PM	18	45	6	0	1	5	9	0	1	42	2	0	3	4	2	0	0	138	138
12:30 PM	8	62	18	2	3	5	6	0	2	62	2	0	10	7	3	0	2	188	190
12:45 PM	13	51	11	3	5	4	13	0	1	53	4	0	9	6	2	0	3	172	175
Total	48	197	43	5	10	18	40	0	5	209	11	0	36	27	8	0	5	652	657
*** BREAK ***																			
04:00 PM	9	13	3	0	1	5	24	0	0	70	1	0	6	5	0	0	0	137	137
04:15 PM	16	25	6	0	2	1	15	0	2	61	0	0	4	2	1	0	0	135	135
04:30 PM	8	17	3	0	2	0	15	1	2	85	0	0	9	1	0	0	1	142	143
04:45 PM	6	24	6	0	0	3	21	0	1	77	2	0	5	7	0	0	0	152	152
Total	39	79	18	0	5	9	75	1	5	293	3	0	24	15	1	0	1	566	567
05:00 PM	5	21	5	0	1	0	19	1	1	70	0	0	7	9	0	0	1	138	139
05:15 PM	11	11	2	0	0	2	13	0	1	60	2	0	5	6	0	0	0	113	113
05:30 PM	15	15	0	0	0	0	14	0	0	45	3	0	0	2	0	0	0	94	94
05:45 PM	10	13	0	0	1	1	11	0	0	58	4	0	1	2	0	0	0	101	101
Total	41	60	7	0	2	3	57	1	2	233	9	0	13	19	0	0	1	446	447
Grand Total	283	964	142	5	42	71	310	15	30	1128	46	8	130	106	20	0	28	3272	3300
Apprch %	20.4	69.4	10.2		9.9	16.8	73.3		2.5	93.7	3.8		50.8	41.4	7.8				
Total %	8.6	29.5	4.3		1.3	2.2	9.5		0.9	34.5	1.4		4	3.2	0.6		0.8	99.2	
Unshifted	283	964	142		42	71	310		30	1128	46		130	106	20		0	0	3300
% Unshifted	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	0	0	0	100
Bank 1	0	0	0		0	0	0		0	0	0		0	0	0		0	0	0
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

**MCV Associates, Inc.**

4605-C Pinecrest Office Park Dr  
Alexandria, VA 22312  
703-914-4850

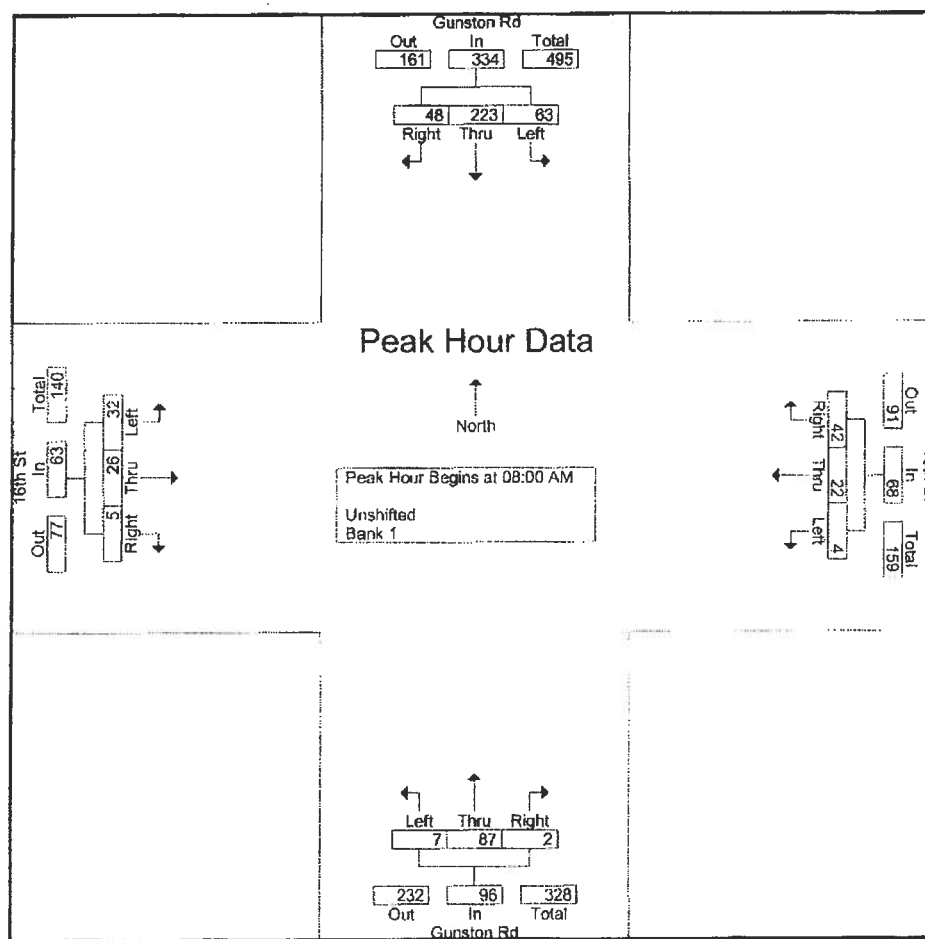
File Name : Gunston Rd 16th St

Site Code : 00000096

Start Date : 5/22/2008

Page No : 2

	Gunston Rd From North				16th St From East				Gunston Rd From South				16th St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	18	77	11	106	0	5	9	14	1	23	1	25	8	4	1	13	158
08:15 AM	15	44	19	78	1	6	7	14	5	23	0	28	5	5	1	11	131
08:30 AM	20	44	12	76	2	7	15	24	1	24	1	26	9	8	1	18	144
08:45 AM	10	58	6	74	1	4	11	16	0	17	0	17	10	9	2	21	128
Total Volume	63	223	48	334	4	22	42	68	7	87	2	96	32	26	5	63	561
% App. Total	18.9	66.8	14.4		5.9	32.4	61.8		7.3	90.6	2.1		50.8	41.3	7.9		
PHF	.788	.724	.632	.788	.500	.786	.700	.708	.350	.906	.500	.857	.800	.722	.625	.750	.888



**MCV Associates, Inc.**

4605-C Pinecrest Office Park Dr  
Alexandria, VA 22312  
703-914-4850

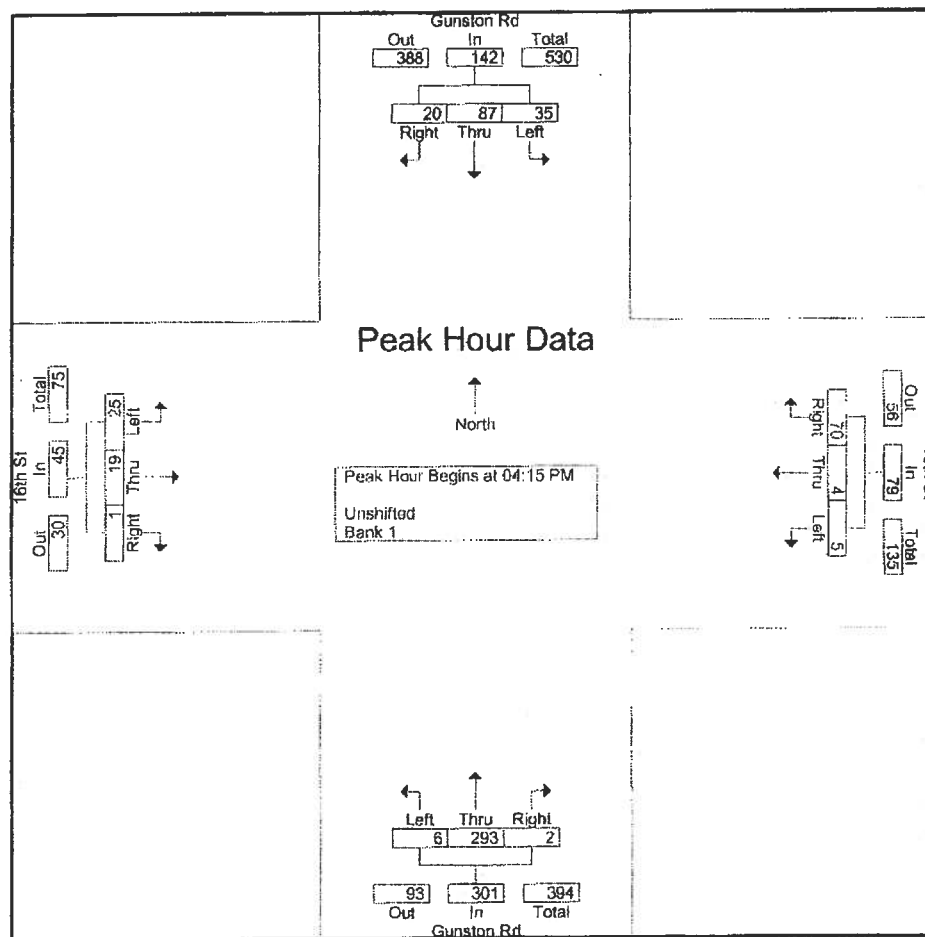
File Name : Gunston Rd 16th St

Site Code : 00000096

Start Date : 5/22/2008

Page No : 4

	Gunston Rd From North				16th St From East				Gunston Rd From South				16th St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:15 PM																	
04:15 PM	18	25	6	47	2	1	15	18	2	61	0	63	4	2	1	7	135
04:30 PM	8	17	3	28	2	0	15	17	2	85	0	87	9	1	0	10	142
04:45 PM	6	24	6	36	0	3	21	24	1	77	2	80	5	7	0	12	152
05:00 PM	5	21	5	31	1	0	19	20	1	70	0	71	7	9	0	16	138
Total Volume	35	87	20	142	5	4	70	79	6	293	2	301	25	19	1	45	567
% App. Total	24.6	61.3	14.1		6.3	5.1	88.6		2	97.3	0.7		55.6	42.2	2.2		
PHF	.547	.870	.833	.755	.625	.333	.833	.823	.750	.862	.250	.865	.694	.528	.250	.703	.933





**DEPARTMENT OF THE ARMY**  
**INSTALLATION MANAGEMENT AGENCY**  
**HEADQUARTERS, UNITED STATES ARMY GARRISON, FORT BELVOIR**  
**9820 FLAGLER ROAD, SUITE 213**  
**FORT BELVOIR, VIRGINIA 22060-5928**

REPLY TO  
ATTENTION OF

IMNE-BEL-EL

25 October 2005

MEMORANDUM FOR US Army Fort Belvoir Personnel

SUBJECT: Fort Belvoir Policy Memorandum # 1, Excavation Work Permit  
Requirements and Procedures

1. PURPOSE. To provide guidance on requirements and procedures for excavation work permits.
2. APPLICABILITY. This policy applies to any agency, activity, company or individual who desires to perform any and all types of excavation work on Fort Belvoir.
3. POLICY.
  - a. Any agency, activity, company, or individual who desires to perform any type of excavation work on Fort Belvoir must obtain an excavation permit prior to commencement of that work in order to minimize the risk of damage to underground utilities and/or communications. Excavation work may include installation of signs and/or fence posts; planting of trees, shrubs, etc.; and digging for any reason. Excavation clearance is necessary in order to ensure the safety of those individuals doing the work; to avoid costly repairs to utility or communication systems; and avoid the expense and inconvenience caused by interruptions of utility service.
  - b. Prior to undertaking any activity which involves digging, an excavation permit must be obtained from the Directorate of Public Works (DPW), 9430 Jackson Loop, Room 111. When appropriate for the work to be accomplished, a drawing showing the general layout and path of the proposed excavation will be provided with the permit request. The requester is required to stake or flag the excavation route every 30 feet. DPW will process the permit for excavation. Processing of this permit will take approximately 10-14 days. When each activity has signed the permit, the permit will be assigned an excavation risk classification and expiration date as follows: Class I, severe risk, 15 days; Class II, minimal risk, 30 days. The risk classification is based on the number of utilities and communications lines in the area to be excavated. In addition to the aforementioned requirements, the requester is required to contact Miss Utility at 1-800-552-7001 to obtain clearances and is responsible for following their procedures as well.
  - c. Once the permit is approved, it must be kept on-site at all times. The party granted the excavation permit is required to hand-dig within a 10-foot radius of the locator's marks until the exact location of all lines have been determined. If the work is going to exceed the permit expiration date, the requester shall call DPW for an extension. The expiration date will be extended only if the utility and communication marks are maintained by the requester; if not, all excavation work will stop until a new permit is approved.

**“EXCELLENCE THROUGH SERVICE”**

IMNE-BEL-EL

SUBJECT: Fort Belvoir Policy Memorandum # 1, Excavation Work Permit Requirements and Procedures

d. The Government, regardless of the type of excavation, reserves the right to have DPW personnel present on-site during any excavation. The Government, at the time of excavation permit processing, will specify on the permit (to include a name and telephone contact number) if DPW personnel are required to be present during excavation. If the excavation permit specifies that a Government representative(s) will be present, the excavator will notify the Government point of contact listed on the excavation permit not less than 24 hours (one full working day) before excavation begins. Failure by the excavator to notify the point of contact listed on the excavation permit may result in the issuance of a "stop work" order by the appropriate authority.

e. The requester shall protect from damage all existing improvements, utilities, communications and vegetation at or near the work site. The requester may be held liable for any damage to Government property that is determined to have occurred as a result of the requester's fault or negligence.

4. PROPONENT. The Directorate of Public Works is the proponent for this policy at (703) 806-3765.

  
BRIAN W. LAURITZEN  
COL, FA  
Garrison Commander

Expiration Date

of Permit: \_\_\_\_\_

Permit #: \_\_\_\_\_

**MARKINGS MUST BE MAINTAINED  
U.S. ARMY GARRISON, FORT BELVOIR  
DPW EXCAVATION PERMIT**

<b>A. REQUESTER</b> _____ <b>P.O.C.:</b> _____ <b>Tele #:</b> _____ <b>Date Clearance Req'd:</b> _____	<b>B. EXCAVATION RISK:</b> <b>CLASS I (SEVERE)</b> _____  <b>CLASS II (MINIMAL)</b> _____	<b>DPW</b> _____    <b>DOIM</b> _____	<b>EXPIRATION</b> <b>15 DAYS</b>   <b>30 DAYS</b>
---	--	---	---

**C. LOCATION OF AREA TO BE EXCAVATED:** (NOTE: A to-scale drawing of the excavation site (highlighted) must be submitted along with this form. Excavation route must be staked, painted or flagged by the requester every 30 feet.)

**D. TYPE OF WORK TO BE PERFORMED:**

**E. MISC INFORMATION:**

- (1) This excavation request is used for any work on post that may disrupt underground utilities, communications, right of ways or any routine activities.
- (2) Processing of this permit will take approximately 10-14 days. Requester must have an approved excavation permit prior to commencement of work, and permit must be kept on-site.
- (3) If utilities or communications have been located in the area to be excavated, hand digging will be used within 10 foot radius until the exact location of all lines has been determined. If markings are maintained by the requester, an extension may be given to the expiration date if needed.
- (4) The Government reserves the right to have on-site personnel present during any excavation and will specify on this permit under precautionary measures if needed.
- (5) The requester shall protect from damage all existing improvements, utilities, communications and vegetation at or near the work site. The requester shall be liable for all damages to persons or property that occur as a result of the requester's fault or negligence.
- (6) Any questions regarding this excavation permit may be directed to the Utility Services Officer at 703-806-3765.

**I HAVE FULLY READ AND UNDERSTAND THE ABOVE NOTES**

\_\_\_\_\_  
Signature of Contractor / POC

\_\_\_\_\_  
Date

**F. REQUESTER ACTION #9 (See item G on back of form for directions)**

	<u>Risk Assessments if Damage Occurs</u> <u>Facilities/Areas Effective</u>	<u>Initial/Date</u>
(1) Business Mgmt.	_____	_____
(2) KIRA Work Order # _____	_____	_____
Electrical	_____	_____
Mechanical	_____	_____
Sanitation	_____	_____
(3) Fire Prevention	_____	_____
(4) Environmental	_____	_____
(5) Master Planning	_____	_____
(6) Provost Marshal	_____	_____
(7) DOIM	_____	_____
(8) Safety Office	_____	_____
(9) Miss Utility # _____	_____	_____

**PRECAUTIONARY MEASURES:** \_\_\_\_\_

**G. DIRECTIONS FOR REQUESTER ACTION:**

- |  |   |
|--|---|
| (1) Business Mgmt.<br>703-806-3925         | 9430 Jackson Loop, ATTN: Janet Lower, Rm 105. Initiate Excavation Permit at least 15 days prior to commencement of work.  |
| (2) KIRA<br>703-806-4793                   | 9460 Jackson Loop, Attn: Debbie Cooper, Contract Management Division will forward to KIRA.  |
| (3) Fire Prevention<br>703-805-2091        | 9701 Gunston Road, Bldg. 191 Fire Inspector's Office for signature on permit for any work that may result in a road closure.  |
| (4) Environmental<br>703-806-0046          | 9430 Jackson Loop, Rm 200. Environmental Office.  |
| (5) Master Planning<br>703-806-0045        | 9430 Jackson Loop, Rm 212. Fac Planning Office for signature on permit.   |
| (6) Provost Marshal<br>703-806-3104        | 6080 Abbot Road, Bldg. 2124 Operations Office for signature on permit for any work that may result in a road closure.   |
| (7) DOIM<br>703-704-2517                   | 10105 Gridley Road, Bldg. 312, Rm. 205 ATTN: Brenda Rulapaugh.  |
| (8) Safety Office<br>703-704-0649          | 10100 DuPortail Road, Bldg. 319 ATTN: Scott Bruning, Fort Belvoir is a Federal OSHA VPP site, and the safety record of potential contractors may be examined. All work shall comply with OSHA safety laws & industry standards. Report accidents to Safety at (703) 704-0649. |
| (9) Miss Utility<br>800-552-7001<br>or 811 | Call Miss Utility at least 48 hrs in advance of excavation. Provide all information Items A & C on the front of this form. A Control number will be provided by Miss Utility. Must be updated every 14 days.  |
| (10) Operations<br>703-806-3765            | 9430 Jackson Loop, ATTN: Mike Smith, Rm 100. Contractor/POC must obtain approval of excavation permit prior to commencement of work.  |

**H.**

Approved \_\_\_\_\_

Name and Title of Authorizing Official

Disapproved \_\_\_\_\_

\_\_\_\_\_



**Michael G. Smith**  
**Utility Services Officer**  
**Directorate of Public Works**

**Date**

*Load Letter*

<b>General Information</b>		
Service Location (Street Address)		Type of Business
Electrician	Address	Phone
Customer	Address	Phone ( )
Total Square Footage	Conditioned Space Square Footage	Type of Heat

<b>Similar Account Information (Buildings of like types of business, square footage, operating hours and heating type)</b>		
Name of Similar Business	Address of Similar Business	(Dominion) Similar Account Numbers(s)

<b>Type of Service (Check all that apply)</b>		
<input type="checkbox"/> Underground	<input type="checkbox"/> Service Change (Rewire)	<input type="checkbox"/> New
<input type="checkbox"/> Overhead	<input type="checkbox"/> Relocation	<input type="checkbox"/> Temporary

<b>Service Characteristics</b>		
Size of Load Wires _____	Sets of Load Wires Per Phase _____	Load Wire Type <input type="checkbox"/> AL <input type="checkbox"/> CU
Terminations: <input type="checkbox"/> Meterbase <input type="checkbox"/> Connection Box <input type="checkbox"/> C.T. Cabinet <input type="checkbox"/> Switchgear/Manf. # _____ <input type="checkbox"/> Other _____		

<b>Service Size</b>		
<input type="checkbox"/> 100 amp <input type="checkbox"/> 150 amp <input type="checkbox"/> 200 amp <input type="checkbox"/> 300 amp <input type="checkbox"/> 400 amp <input type="checkbox"/> 600 amp <input type="checkbox"/> Other _____		

<b>Voltage</b>		
<input type="checkbox"/> 1 Phase, 3 Wire, 120/240	<input type="checkbox"/> 3 Phase, 4 Wire, Delta, 120/240 (Limited to 200 amps or less per service connection)	
<input type="checkbox"/> 3 Phase, 4 Wire, Wye, 120/208	<input type="checkbox"/> 3 Phase, 4 Wire, Wye, 277/480 <input type="checkbox"/> Other (Must be approved by Dominion)	

Electric Load (Excluding Motor Load)				Electric Motor Load (Except Heating and AC)				
Interior Lighting	_____ kw	Computers	_____ kw	Phase	Number of Motors	HP	Voltage	Hours of Operation Per Week
Exterior Lighting	_____ kw	Receptacles	_____ kw	_____	_____	_____	_____	_____
Electric Cooking	_____ kw	Refrigeration	_____ kw	_____	_____	_____	_____	_____
Water Heating	_____ kw	Other	_____ kw	_____	_____	_____	_____	_____
Dryer	_____ kw	Other	_____ kw	_____	_____	_____	_____	_____
Heat Pump	_____ kw	Other	_____ kw	_____	_____	_____	_____	_____
Heat Pump Strip Heat	_____ kw	**Future	_____ kw	_____	_____	_____	_____	_____
Electric Heat (Baseboard or Furnace)	_____ kw			_____	_____	_____	_____	_____
AC (Data Processing Load Only)	_____ tons			Please attach list of additional motors if insufficient space above.				
AC (Not Including Data Processing)	_____ tons							

<b>Estimated Business Operating Time</b>		<b>*Meter Location Desired</b>	
Hours Per Week _____	Months Per Year _____	<input type="checkbox"/> Indoor	<input type="checkbox"/> Outdoor
<b>Load Management Device</b>		<b>*Service Equipment Location Desired</b>	
<input type="checkbox"/> Yes <input type="checkbox"/> No	If Yes, setting _____	<input type="checkbox"/> Indoor	<input type="checkbox"/> Outdoor

The information provided in this document, by the customer, is critical to Dominion in sizing our electrical facilities to provide reliable service to you. This information will also be used to determine the installation cost for electrical service.

All conductors must enter from top and bottom (not side or back) of the instrument transformer cabinet. Line and load conductors must enter from opposite ends of the cabinet so that metered and non-metered conductors will not cross.

**\*The company reserves the right to designate and/or approve the location of all metering and C.T. equipment. The company must approve all proposed metering arrangements.**

**\*\*The customer must notify Dominion prior to the actual connection of any future load (as required by Information and Requirements for Electric Service *The Blue Book*).**

Signature	Date
-----------	------

Distribution: Please return this form to the local Dominion office that will be installing this service, or call 1-888-667-3000.

Form No. 725071 (Nov 2003)  
©2003 Dominion Resources Services, Inc.

**Instructions for Completing the Load Letter (Form No. 720571)****General Information**

<b>Service Location (Physical Location)</b>	Street Address, City & State of building being served.
<b>Type of Business</b>	Type of business being served (i.e. restaurant, office, etc.).
<b>Electrician, Address, Phone</b>	Name, address and phone number of the electrician performing new work on this building.
<b>Customer, Address, Phone</b>	Name of the ultimate customer along with their present address and phone number.
<b>Total Square Footage</b>	Total floor space of building.
<b>Conditioned Space Square Footage</b>	Floor space of the building subject to heating and cooling.
<b>Type of Heat</b>	Electric, Gas, Propane, Oil Other (please specify).

**Similar Account Information (Buildings of like square footage and heating type)**

<b>Name of Similar Business</b>	Name of similar business (must be similar size and heating type).
<b>Address of Similar Business</b>	Physical location of similar business (must be similar size and heating type).
<b>(Dominion) Similar Account Number(s)</b>	Dominion account number (if known) of the similar business (list several if possible – must be similar size and heating type).

**Type of Service (Check all that Apply)**

Check all that apply to the new service being provided.

**Service Characteristics**

<b>Load Wires</b>	Include conductor size, number of sets, and type of load conductors.
<b>Terminations</b>	Indicate where the customer's conductors and Dominion conductors will terminate together. If in a switchgear, please provide the specific number and manufacturer of the gear.

**Service Size**

Check the size of your panel or switchgear.

**Voltage**

Check the voltage that you want delivered to the building.

**Electrical Load (Excluding Motor Load)**

List all non-motor electrical loads at this location in terms of kw and tons.

**Electric Motor Load (Except Heating and AC)**

List all of the motors that will be used at this location along with the number of motors, horsepower, voltage and hours of operation per week (except Heating and AC).

**Load Management Device**

If you are limiting the kw demand to a certain level with an automated device, check "Yes." If "Yes", enter the maximum kw setting of the device.

**Estimated Business Operating Time**

<b>Hours Per Week</b>	Enter how many hours per week the business will be in operation.
<b>Months Per Year</b>	Enter how many months per year the business will be in operation.

**Meter Location Desired**

Check the location you prefer for the meter (subject to Dominion approval).

**Service Equipment Location Desired**

Check the location you prefer for the service equipment (subject to Dominion approval).

**FIRE STATION PROJECT- DISTRIBUTION LIST****AGENCIES****USACE-NAB-EN-D**

10 S Howard Street  
Baltimore MD 21201

**Attn: Dan Wright**

**USACE-Fort Belvoir IPO**

6050 First Street  
P.O Box 89  
Fort Belvoir, VA 22060

**Attn: John Devine/Mike Armstrong**

**Directorate of Pubic Works**

9430 Jackson Loop  
Fort Belvoir, VA 22060-5116

**Attn: Mike Groeneveld**

**Directorate of Emergency Service**

6080 Abbott Road  
Fort Belvoir, VA 22060-5116

**Attn: Jeffery Nesmeyer**

**Fire Department**

9430 Jackson Loop  
Suite 107, (Bldg 191)  
Fort Belvoir, VA 22060-5130

**Attn: John Weaver**

**Directorate of Information System**

10109 Gridley Rd.  
Bldg. 314 - Basement  
Fort Belvoir, 20060

**Attn: Rondell Briggs**

**USACE- Huntville Center**

4820 University Sq  
3F511  
Huntsville, AL 35816

**Attn: Juan Pace-**

Interim			Final		
PDF & DWG CD- ROM	Full Size Plans	Half Size Plans	PDF & DWG CD-ROM	Full Size Plans	Half Size Plans
1		5	2		2
1		2	2	1	2
1	1	2	1		2
1		1	1	1	1
1	1	1	1	1	1
1		1	1	1	1
1		1	1	1	1



**Washington  
Gas**

# Service/Information Request

## Company Requesting Information

Company:		Phone No
Contact Person		Phone No.:
Address:		
City	State:	Zip Code:
Project Name:		
Address:		Closest Intersection:
City:	State:	Zip Code:

## Project

## Information Required

- ☒ Request for gas service   
 ☐ Gas Pricing Information   
 ☐ Preliminary inquiry of gas availability   
 ☐ Inquiry of rebate availability  
☐ Other (explain): \_\_\_\_\_  
☐ If existing customer, please give Washington Gas Account # \_\_\_\_\_

Please provide much of the following information as is available when filing out this request.

- Residential:**   
 ☐ Single Family   
 ☐ Townhouse   
 ☐ Garden Apartments   
 ☐ High Rise Apartments  
**Commercial:**   
 ☐ Office Building   
 ☐ Dry Cleaners   
 ☐ Industrial Processing   
 ☐ Restaurant   
 ☐ Food Stores  
☐ Motels/Hotels   
☐ Religious Building   
☐ Warehouse/Light Industry   
☐ Medical Building   
☐ School  
☐ Retail   
☐ Other \_\_\_\_\_  
☐ Conversion   
☐ New Construction

List proposed equipment by type and BTUH input rating. Indicate the operating schedule of any process applications. List boilers by BTUH input rating and indicate if boilers are dual-fueled. List make-up air units by BTUH input rating and CFM supplied. List absorption air conditioning by BTUH input and tonnage supplied. List existing equipment that will continue to be utilized in the left columns. List new/added equipment in the right columns.

		BTUH Input			BTUH Input
QTY.	Existing Equipment Description	Rating	QTY.	New Equipment Description	Rating
			0		0
			0		0
			0		0
			0		0
			0		0
<b>Total BTUH Input (All Equipment-New and Existing): Total BTUH</b>					0

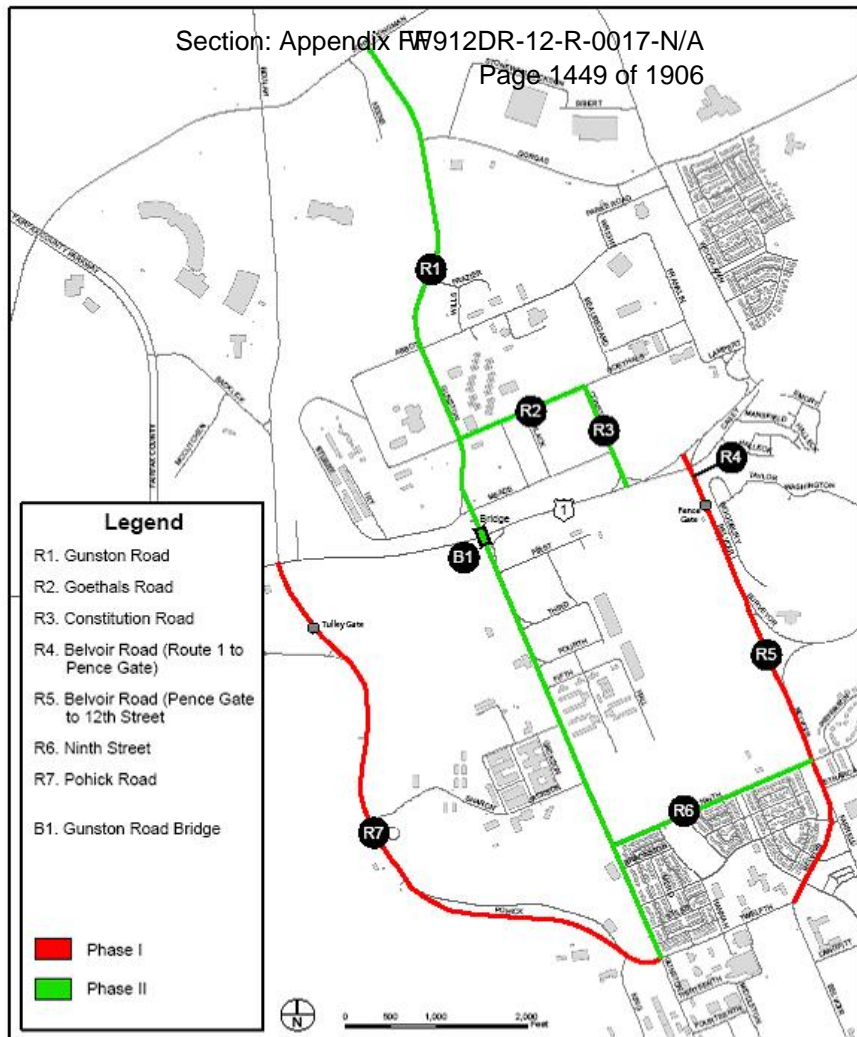
Type of Gas Service Requested: <input type="checkbox"/> Firm <input type="checkbox"/> Interruptible <input type="checkbox"/> If interruptible, alternate fuel _____		Gas Pressure Requested at Meter Outlet: <input type="checkbox"/> Standard low pressure (6" w.c.) <input type="checkbox"/> <del>EMS</del> Desired <input type="checkbox"/> Other _____ psig	
Local Contact:	Phone No.:	General Contractor:	Phone No.:
Architect:	Phone No.:	Developer:	Phone No.:
Engineer:	Phone No.:	Owner:	Phone No.:

**Important:** Please include two copies of site plan and additional mechanical drawings showing location of water, sewer, and other underground utilities, and desired location of gas service line and meters.

Today's Date:
Date Information Needed:
Date Gas Piping Installation Required:
Signature:
E-mail address:

## Send Request to:

**Rick Walsh**  
 Washington Gas Sales Representative  
 Room-202-L  
 6801 Industrial Road  
 Springfield, Virginia 22151  
 Rwalsh@Washgas.com  
 (703) 750-7532(Phone)  
 (703) 750-4546(FAX)



March 18, 2008

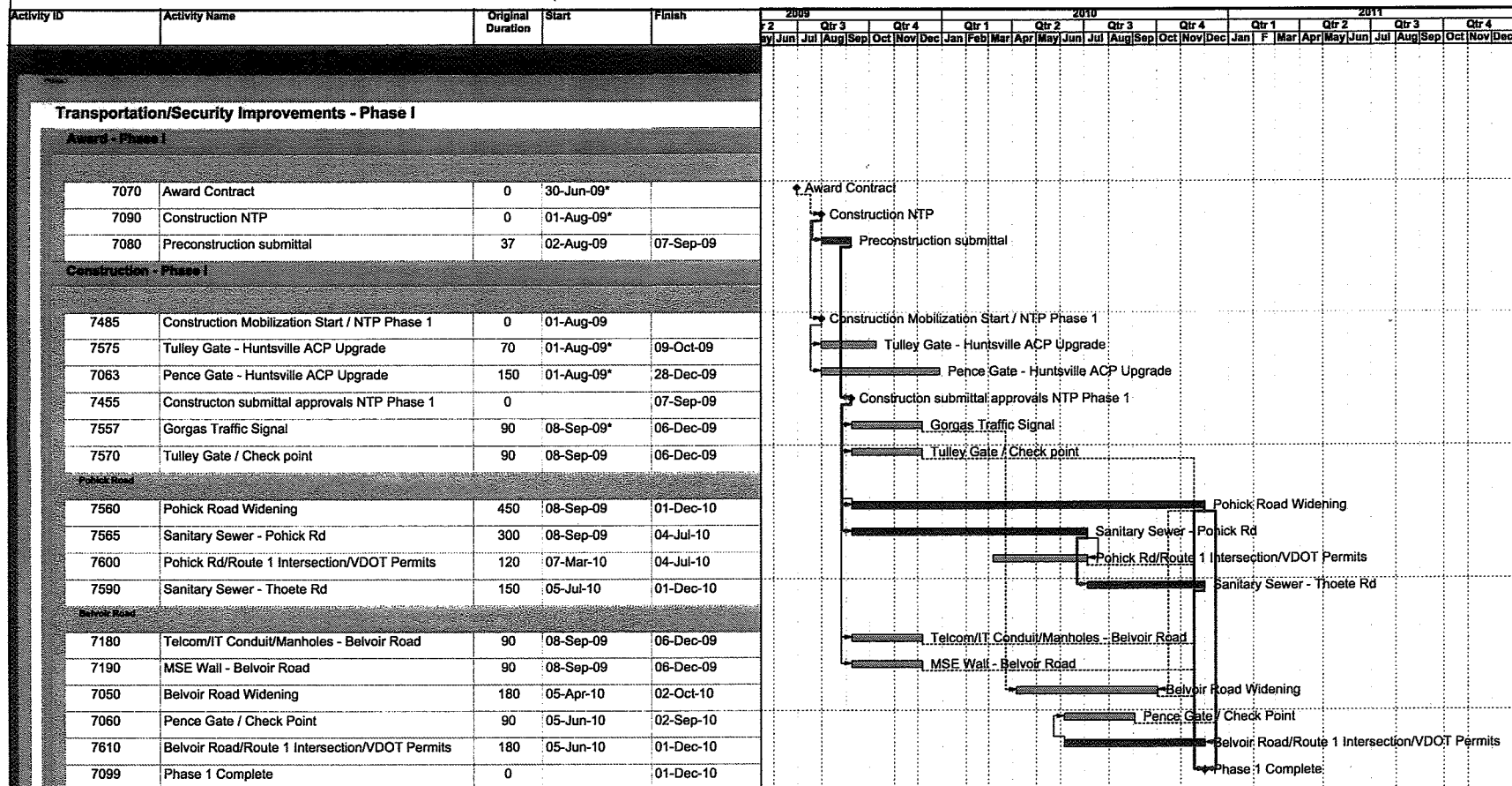
## Roadways & Bridges

Main Post Infrastructure Reference Map  
Information Only - Subject to Revision, 2012

# Ft. Belvoir - Main Post - Phase 1 Construction

08-Apr-09

Page 1 of 1



Actual Work
  Remaining Work
  Critical Remaining Work
  Milestone

**Ft. Belvoir - Main Post - Phase 1 Construction**

**Project Schedule**

Richard Barrett | Project Controls Manager

Jacobs Global Building, NA | 1100 N. Glebe Road #500  
Arlington, VA 22201

## Appendix GG – Installation Design Guide

Available from the Contracting Officer upon request.



## Appendix HH

### American Water Design Guide for Water and Wastewater Facilities

## **Administrative Requirements**

### **General Information**

This design guide provides a summary of the overall project submission and approval process that all developers and government agencies must follow for any proposed expansion of, or connection to, American Water Military Services Group (AW) owned utilities at Ft. Belvoir, VA. This document provides only a summary of design standards that all projects shall adhere to and is not an all encompassing guide. All projects must adhere to the full requirements as put forth in American Water's Standard Specifications for Construction of Water and Wastewater Facilities, a copy of which can be obtained from the AWE Utility Manager.

AWE reserves the right to specify the point of service, the size of service, the type of service, and the general layout of the overall system within the guidelines of this document.

### **Permits**

For projects that require a permit from the State permitting agency, American Water shall be the Permittee on the application. A copy of signed 100% plans and permit applications shall be provided to AW for review and permit signature. All signed permit applications will be returned to the design engineer for their submission to the State. AW shall not be responsible for the submission of any permit application to State agencies.

All projects that are to connect to AW's water and sewer system require submittal and approval of the American Water Permit Application for Water or Sewer Tap and/or Line Installation. A copy of the permit application is provided in Appendix A of this design guide.

### **Plan Requirements**

Two sets of design plans shall be submitted to the AW Utility Manager. The turnaround time for a review memo from AW shall be a minimum of 10 business days.

As a minimum plan requirement, the following shall be included in the design drawings:

- All materials shown and clearly labeled (pipe, valves, fire hydrants, water meters, fittings, manholes, services, etc.) with associated elevations, sizes, types, composition, slopes, and appurtenances.
- Approximate topographical location of existing utilities within the immediate vicinity of the project.
- Plan and profile sheets shall include all sewer design information including pipe size, length, material, slope, and invert elevations.
- Plan and profile sheets shall show existing and proposed grades, the location of new gravity sewers and force mains, and all utility crossings.

Military Services Group  
Design Guide for Water and Wastewater Facilities

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- Ownership of the proposed utility system shall be clearly designated as 'AWE' as appropriate.
- Detailed architectural and mechanical plans for any proposed structures for lift stations or booster stations.
- Site plan for any proposed water and sewer facility.
- Water and Sewer construction details.

The following standard Water and Sewer Construction Notes shall be included on all plans submitted to AW for approval:

1. All materials, workmanship, and testing shall conform with American Water's Standard Specifications for Construction of Water and Sewer Facilities.
2. Contractor to coordinate all shut downs and utility connections with American Water.
3. Disinfection of all water mains shall be performed in accordance with American Water Standard Specifications.
4. All service connections are to be made wet after completion of pressure testing and main disinfection and after main has been found acceptable by American Water
5. Contractor shall provide 72 hours notice to the American Water Utility Manager prior to any construction.
6. The sewer mains and service lines shall be laid a minimum distance of 10 feet (10') from any existing or proposed parallel water main. The mains and service lines shall be encased in reinforced concrete or constructed of ductile iron pipe with the required lining and encasement for a distance of ten feet (10') in each direction from a crossing with a water main when the sewer line does not have a minimum vertical clearance of eighteen inches (18") from the water line crossing. Linings and the encasement for the ductile iron pipe shall be as noted on the drawings and specified in American Water Standard Specifications.
7. All utilities shall be constructed with a minimum cover of 42".
8. All sanitary sewer mains, stubs, and cleanouts installed on the project shall be air-tested and manholes vacuum tested after the backfill and compaction operations have been completed. All tests shall be witnessed by a representative of the Engineer. Copies of all test records shall be provided to American Water for project acceptance.

## Required Submittals

For certain projects, AW will require the following submittals in addition to the project plans:

1. For any lift station or booster station, hydraulic calculations, signed and sealed by a Professional Engineer registered to practice in Virginia, shall be provided. The calculations shall include influent flow projections, hydraulic analysis of the lift station (or booster station) and force main, pump information including the operating point and pump curves, buoyancy calculations, and electrical power requirements for all lift station electrical equipment.
2. Fire Flow requirements for any proposed structure.
3. For large system additions or demands, a hydraulic model of the expanded utility system may be required. Any hydraulic model analysis performed by AW shall be paid for by the agency submitting the project application.

## Pre-Construction Meeting

The Contractor shall schedule a meeting with the AW Utility Manager to discuss coordination efforts that shall be required between the Contractor and AW over the course of construction.

## Construction Inspection

All utility line installation and connections to the existing utility systems shall be inspected by AW or an agent of AW prior to backfill. Contractors shall provide 72 hours to the AW Utility Manager for all required inspections.

The costs for these inspections are reimbursable to AW.

## Shop Drawings

Shop drawings/submittals for all water and wastewater construction items shall be submitted to American Water for review and approval prior to construction. Shop drawings shall be provided for, but not limited to, pipes and piping appurtenances, valves, fire hydrants, and pumps.

One copy of shop drawings shall be provided to AW for review and the Contractor may submit shop drawings to AW electronically.

### **As-Built Drawings**

The contractor shall provide As-Built plans showing the locations of the services and all other water and sewer system changes in electronic format to AW for inclusion in its GIS system upon completion of the project.

### **System Acceptance**

Prior to American Water accepting any utility system expansion, the following items are required:

1. All pressure tests have been successfully completed for all pressurized mains.
2. All bacteriological clearances for potable water mains have been received.
3. A completed AW permit has been provided and approved.
4. As-Built drawings have been submitted and approved by AW.

## **WATER DESIGN GUIDELINES**

### **Overview**

This design guide section provides the minimum AW guidelines for the design of sanitary sewer systems, including collection systems, force mains, and lift stations. All sewer design shall be performed in accordance with generally accepted engineering standards and practices, this design guide, American Water Standard Specifications for construction of Wastewater Facilities, and all applicable local and state regulations.

### **General System Design**

Proposed extension of the water distribution system in non-residential area shall be a minimum of 12" in diameter, unless the distribution system is a closely interconnected grid system, where 8" diameter water mains may be utilized. Water mains within residential areas, as well as in non-residential areas with a closely interconnected grid system, shall be a minimum of 8" in diameter. Water mains smaller than 6" are not permitted within the AW distribution system. Deviations from this general policy may be permitted by AW should the design Engineer provide adequate justification for said deviation.

Upon request from AW, the design Engineer shall provide hydraulic calculations for review. For major distribution system expansion, AW reserves the right to require the design Engineer to utilize a hydraulic model to accurately analyze the effect the proposed system expansion will have on daily operations on the water distribution system.

All distribution system expansions shall be designed with a minimum of two feed lines in order to create a looped distribution system. Dead end lines will not be permitted without approval by AW. If a dead end line is approved, the main must be provided with either a flushing hydrant or automatic flushing station.

### **Design Flows**

All distribution system expansions shall be sized to provide, at a minimum, the maximum day domestic flow plus fire flow with residual pressures not dropping below 20 PSI at any point within the existing distribution system. All application submittals to AW should provide design data used to calculate the projected water demand.

### **Fire Flow requirements**

American Water is not responsible for calculating fire flow requirements for proposed projects. It is the responsibility of the design engineer to provide hydraulic calculations showing required fire flow is available for the proposed project.

Military Services Group  
Design Guide for Water and Wastewater Facilities

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### Location of water mains and appurtenances

Water mains shall be located outside of paved areas wherever possible unless ground topography or a roadway crossing dictates otherwise. Water mains shall be constructed a minimum of 3' from pavement or sidewalks. A minimum of 10' horizontal clearance is required between water mains and sanitary sewer mains or stormwater mains, and 5' between water mains and all other utilities (other water mains, gas, telephone, electric, etc.).

### Depth

All water mains and water service lines shall have a minimum cover depth of 42".

### Size

American Water does not permit water mains smaller than 6" are not permitted within the distribution system. The minimum allowable size for all water main extensions is 8".

Fire hydrant laterals are exempt from this requirement. The minimum allowable size of a hydrant lateral is 6".

### Materials of Construction

Water Pipe: (PVC Schedule 40 or 80 is not permitted)

Type of service	Acceptable Materials	Comments	Spec Section
Service line smaller than 4 inches	Type K copper, HDPE SDR 13.5;		02503 02505W
Mains and services 4" and larger and depth of cover	HDPE SDR 13.5; PVC C900 150 psi rating; Ductile Iron Pipe pressure class 300		02501 02502 02503 02505W 02506 02507
Above ground	Ductile Iron		02501

### Fire hydrants

Fire hydrants shall conform to AWWA C502, Standard for Dry Barrel Fire Hydrants (Latest Edition). Hydrants shall be open counterclockwise. The approved hydrant type shall be determined by the AW Utility Manager. Alternate hydrants will not be considered. All hydrants shall be furnished with 6" auxiliary gate valves.

Hydrants shall be painted in accordance with the local base requirements.

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Design Guide for Water and Wastewater Facilities

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Hydrants shall be placed at or near street intersections, and at the end of permanent dead end lines. Spacing of fire hydrants shall not exceed 500 feet in residential areas, and 300 feet in commercial areas. No obstructions or permanent structures shall be located within 10' of any fire hydrant.

### Valves

Gate valves shall be of the resilient-seated type and shall be in conformance with AWWA C509. Gate valves shall be used on all water mains up to 24" in diameter. On water mains 24" in diameter and greater, valves shall be butterfly valves.

Valve spacing shall not exceed 500 linear feet within residential areas and 1,000 linear feet in commercial areas. For transmission mains, valves shall be provided at a minimum of 2,500 foot intervals.

At pipe intersections, valves shall be provided on each branch of the water main intersection.

### Water Meters

Where required, water meters less than 1 ½" in size shall be Neptune Model T10 (ProRead Gallon 6 wheel plastic bottom) with Neptune Model R900v2-pit style MIU c/w 6-ft of antenna wire. Water meters 1 ½" and greater shall be Neptune HP Turbine meters with Neptune Model R900i-pit style MIU c/w 6-ft of antenna wire. NO EXCEPTIONS are allowed for water meter types.

Water meters shall be located within concrete or cast iron vaults.

### Backflow Prevention

AW requires backflow prevention be provided on all domestic, commercial, and fire service lines that connect to the water distribution system. Backflow prevention shall be in accordance with American Water's Cross Connection Control Program. Backflow prevention devices shall remain the responsibility of the facility owner.

The location of and the specifications for the backflow prevention devices shall be shown on drawing submittals.

### Connection to existing water main

Connections to existing water mains shall be performed by AWE personnel only and will be performed in such a manner as to provide the least amount of interruption to water service. A tapping sleeve and valve will be the preferred method of connecting to an existing water main. If connection to an existing water main requires the closing of



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Design Guide for Water and Wastewater Facilities

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valves that will cause an AW customer to lose water service, provisions shall be made to provide temporary service.

No taps shall be made within 5' of a joint. A minimum of two week notice shall be provided to AW prior to any requested tap installation.

### **Highway and railroad crossings**

All crossings of railroads and multi-lane roadways shall be made by either the jack and bore method or directional drilling. Borings without casing pipe are not permitted. Casing pipe material shall be as strong as carrier pipe, at a minimum.

For two lane roadways, open cutting is not permitted without approval by American Water and FT. Belvoir Public Works Department. If open cutting is not permitted, the roadway crossing shall be performed by boring or tunneling.

## **SEWER DESIGN GUIDELINES**

### **Overview**

This design guide section provides the minimum AW guidelines for the design of sanitary sewer systems, including collection systems, force mains, and lift stations. All sewer design shall be performed in accordance with generally accepted engineering standards and practices, this design guide, American Water Standard Specifications for construction of Wastewater Facilities, and all applicable local and state regulations.

### **Design Flows**

Design flows for all proposed sanitary sewer system expansions shall be determined by the owner's design engineer in accordance with all local, state, and Federal requirements and good engineering practice. Methods and calculations shall be provided to AW.

### **Size and Depth**

All sewers shall be designed to convey peak design flow while flowing full. The proposed peak design flow may not surpass the flow capacity of any pipeline.

The diameter of proposed sanitary sewers shall not exceed the diameter of the existing or proposed outlet, whichever is applicable.

Sanitary sewer lines flowing via gravity shall have a minimum diameter of 8". Sanitary sewer service laterals shall have a minimum diameter of 4" for residential connections and 6" for commercial and industrial connections.

A minimum cover of 3' shall be provided over all gravity sewers and pressurized force mains.

Sanitary sewers shall be placed lower than the basement elevation of the serviced building.

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## Materials of construction

Wastewater Pipe: (PVC Schedule 40 or 80 is not permitted)

Type of service	Acceptable Materials	Comments	Spec Section
Gravity Service lines	PVC SDR 35	Minimum service is 4" diameter	02501 02506
Gravity Mains with depth of cover $\leq$ 10 feet	PVC SDR 35; Ductile Iron Pipe pressure class 300		02501 02506 02507
Gravity Mains with depth of cover 10-15 feet	PVC SDR 26; Ductile Iron Pipe pressure class 300		02501 02506
Gravity Mains with depth of cover >10 feet	Ductile Iron Pipe pressure class 300		02501
Force Mains less than 4 inch diameter	HDPE SDR 13.5; PVC SDR 21 or SDR 26		02502 02505 02506
Force Mains 4 inch diameter and larger	HDPE SDR 13.5; PVC C900 150 psi rating; Ductile Iron Pipe pressure class 300		02501 02502 02505 02506
Above ground	Ductile Iron		02501
Inside wet wells of lift stations	Ductile Iron or stainless steel (no plastic)		02501

## Slope

Sanitary sewers shall be designed to provide a minimum velocity of 2.0 feet per second when flowing half full. Design calculations shall be based on the Manning's formula using an n-value of 0.013. The following slopes shall be the minimum allowable slopes for each pipe diameter as indicated:

Pipe Diameter	Minimum Allowable Slope (%)
8"	0.40
10"	0.28
12"	0.22
15"	0.15
18"	0.12
21"	0.10
24"	0.08
27"	0.065
30"	0.058

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The maximum allowable slope for all gravity sewers shall be such that the velocity within the pipe does not exceed 5 feet per second, as calculated using Manning's Formula.

All proposed sanitary sewer laterals shall have a minimum slope of 2%.

### **Sewer locations**

Sewer mains shall be located outside of paved areas wherever possible unless ground topography or a roadway crossing dictates otherwise. Sewer mains shall be constructed a minimum of 3' from pavement or sidewalks. A minimum of 10' horizontal clearance is required between sanitary sewer mains and water mains or stormwater mains, and 5' between water mains and all other utilities (other water mains, gas, telephone, electric, etc.).

Gravity sewers shall be constructed in straight alignment runs between manholes. Deflection of the horizontal alignment of the gravity sewer in between manholes is not permitted.

### **Sewer and Water Separation**

The sewer mains and service lines shall be laid a minimum horizontal distance of 10' from any existing or proposed parallel water main. The mains and service lines shall be encased in reinforced concrete or constructed of ductile iron pipe with the required lining and encasement for a distance of 10' in each direction from a crossing with a water main when the sewer line does not have a minimum vertical clearance of 18" from the water line crossing. Linings and the encasement for the ductile iron pipe shall be as noted on the drawings and specified in American Water Standard Specifications.

### **Manholes**

Manholes are required at all changes in grade, pipe size, direction, and pipe material. Additionally manholes are required at all sanitary sewer intersections.

Sanitary sewer manholes shall be constructed with concrete only. Brick construction is not permitted. Provide manhole sections, base sections, and related components conforming to ASTM C 478. The minimum internal diameter of a manhole shall be four feet (4') for manhole depths of up to 15'. For manholes of greater depth, internal diameter shall be a minimum of five feet (5'). Manhole spacing shall not exceed 400 LF.

All manhole drop connections shall be outside drops. Internal drops are not permitted. Outside drops shall be provided when the invert elevation into the manhole is 24" greater than the manhole invert.

Doghouse manholes shall be constructed at the intersection of a new sanitary sewer line with an existing sanitary sewer line.

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Sanitary sewer laterals may not connect directly to a manhole.

Manholes that are utilized as the receiving manhole of a force main shall be provided with a fiberglass liner or other appropriate coating to help prevent the early deterioration of the manhole due to the presence of corrosive gases.

### **Force Mains**

All proposed force mains shall be a minimum of 4" in diameter, though exceptions may be granted by AW for low pressure systems or low flow systems that tie directly into a gravity sewer system.

Force mains shall be designed to maintain a minimum scouring velocity of 2.0 feet per second. Velocities within the force main shall not exceed 5.0 feet per second.

Ninety degree bends are not permitted on force mains. Forty-five degree bends shall be provided in lieu of ninety-degree bends. Long sweeps are allowed for HDPE force mains, however the minimum radius of curvature for the long sweep shall be 5'.

Air release valves shall be provided at all high points along the force main alignment. The air release valve assemblies shall be located within concrete vaults or manholes.

## **LIFT STATION DESIGN GUIDELINES**

### **Overview**

The design of lift stations shall be closely coordinated with the AWE Utility Manager. The following information is provided as general identification of issues of concern and guidelines for expected designs, however, local conditions may warrant deviations as appropriate. Lift Station design calculations shall be provided to AWE for review. Lift stations shall be adequately ventilated.

### **Site Plan Requirements**

Site plans shall show the location of lift stations and provide details of lift station construction. Protection of the station from traffic and vandals shall be provided in system design. Secondary containment shall be provided for chemical storage tanks and fuel storage tanks in excess of 50 gallons.

The location of sensitive populations and environmentally sensitive areas shall be shown on the site drawings.

### **Wet Wells**

Wet wells shall be sized to provide adequate storage for grit (minimum of 18-inches required), minimum intake water depth (minimum 1.0 ft required), and minimum pump operating cycles (minimum 5 minutes required) consistent with pump manufacturer recommendations. Where high hydrogen sulfide is expected, the walls of the wet well will be coated to protect the concrete from deterioration.

Wet wells shall be equipped with tear drop floats or ultra-sonic devices to determine water levels. Flotation calculations shall be provided.

All piping material in the wet well shall be stainless steel.

### **Pumps**

A minimum of two pumps shall be provided in each lift station. Pumps shall be designed to handle the design peak hourly flow with the largest pump out of service. Pumps must be capable of passing a 3-inch solid sphere.

Pump manufacturer, type, and size shall be coordinated with AWE to facilitate programs to minimize spare parts inventory and facilitate enhanced maintenance capability. Submersible pumps shall be equipped with stainless steel guide rails and with quick disconnects to facilitate maintenance.

Pressure gauges shall be provided on the discharge of each pump.

## **Valve Vaults**

Separate valve vaults shall be provided for each pump discharge valve set. Metal pipe penetrations of valve vaults shall be isolated from the valve vault walls by elastomer membranes to prevent corrosion of the metal pipe. Shutoff and check valves shall be provided on each pump discharge line.

## **Flow Meter**

Flow meters shall be provided where design flows are 1 MGD or greater.

## **Bypass**

Pump stations shall be designed to provide bypass pumping capability for emergency operation.

## **Control Panel**

Control panels shall provide for manual and automatic operation of pumps. 4-20 milliamp output signals shall be provided to facilitate SCADA system connections for pump motors, valve operators, odor control systems, level monitors, flow meters, and other process critical features of the system.

All control panels shall be at least NEMA 4 enclosures.

The manufacturer and type of control panels shall be coordinated with the AWE Utility Manager to facilitate programs to minimize spare parts inventory and to ensure adequate maintenance capabilities.

## **Back-up Generator**

Emergency power must be provided to the pump station as an emergency generator or as independent power leads from two separate substations.

## **Yard Hydrant/Water Service**

A yard hydrant shall be provided at the pump station to facilitate station cleaning.

## **APPENDIX A**

### **American Water Permit Application for Water/Sewer Tap and Line Installation**



Military Services Group  
Design Guide for Water and Wastewater Facilities

**American Water/ Military Services Group- Utility Owner  
Fort Belvoir, Virginia**

**Permit Application for Water/Sewer Tap and Line Installation**

Permit # \_\_\_\_\_

Application Date: \_\_\_\_\_

Please check boxes that apply:

Water Tap	Water Line	Sewer Tap	Sewer Line	Temporary	Permanent
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Section #1 – General Information**

**Name of Project Sponsor (funding Sponsor)\*** \_\_\_\_\_

\* - This party is responsible for paying costs incurred by AW

Address \_\_\_\_\_

Phone Number \_\_\_\_\_ Point of Contact \_\_\_\_\_

Project Name \_\_\_\_\_ Project No. \_\_\_\_\_

Peak Water Demand \_\_\_\_\_

Fire Flow Requirements \_\_\_\_\_ @ \_\_\_\_\_ for \_\_\_\_\_ hours

Engineer contact information \_\_\_\_\_

\_\_\_\_\_

**Address/Location of Work**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Is a construction permit needed from the State regulatory agency? ☐ Yes ☐ No

(If 'Yes', AW will be the permittee on the application. The application must be submitted with all required fees and documents to AW's local office.)

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Is this a phase of a larger project?

☐ Yes☐ No

(If 'Yes', provide description of whole project.)

**Section #2:****Description of Work** \_\_\_\_\_

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**Lowest Building First Floor Elevation** \_\_\_\_\_**Highest Building First Floor Elevation** \_\_\_\_\_**Pipe Sizes Proposed:**

Water Main

Sewer Main

Force Main

Water  
Service
Sewer  
Service
**Pipe Material:**

<input type="checkbox"/>	PVC C-900
<input type="checkbox"/>	Ductile Iron
<input type="checkbox"/>	HDPE SDR _____
<input type="checkbox"/>	SDR 21 (Service Line Only)

<input type="checkbox"/>	SDR 26 (Service Line Only)
<input type="checkbox"/>	SDR 35 (Gravity Sewer Less Than 10' Bury)
<input type="checkbox"/>	SDR 26 (Depth of Bury 10'-14')
<input type="checkbox"/>	Type K Copper

**Pipe Bedding Details** \_\_\_\_\_

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**Fire Hydrant****Manufacturer** \_\_\_\_\_**Model No.** \_\_\_\_\_**Gate Valves****Manufacturer** \_\_\_\_\_**Model No.** \_\_\_\_\_**Hydrant Flow Tests****Date of Test(s)** \_\_\_\_\_**Flow Measured** \_\_\_\_\_ **GPM****Performed by** \_\_\_\_\_**Hydrant No's** \_\_\_\_\_**Residual Pressure** \_\_\_\_\_**Backflow Prevention\***

<input type="checkbox"/>	Provided in Mechanical Room
<input type="checkbox"/>	Exterior to Building
<input type="checkbox"/>	RPZ
<input type="checkbox"/>	DCV

**Water Meter**

<input type="checkbox"/>	Provided
<input type="checkbox"/>	Not Required

**Size** \_\_\_\_\_ **inch**

\*- Must comply with Cross Connection Control Manual and a certificate shall be provided after installation.

**Pumping Facilities\***☐ Water Booster Station☐ Sewage Pump Station

\* - Design Report and all civil, mechanical, and electrical drawings to be provided.

**Quantities of Materials – Provide a tabulation of pipe (by size and material), manholes, valves (by size), fire hydrants, cleanouts, and other system features.**

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**Section #3: - Project Schedule****Submit permits to regulatory agency** \_\_\_\_\_**Start Construction** \_\_\_\_\_**Complete Construction** \_\_\_\_\_**Section #4:****Construction Cost Estimate** \$ \_\_\_\_\_**Section #5:****If work is not going to be performed by Application Company Identification of Subcontractor:****Company Name** \_\_\_\_\_**Address** \_\_\_\_\_**Phone Number** \_\_\_\_\_**Contact Name** \_\_\_\_\_**Section #6:****Note to All Contractors:**

All work must be constructed in accordance with American Water's Standard Specifications for Water and Sewer Facilities (request copy if needed).

No Work is to be started until Permit has been issued By American Water.

Complete set of Plans is to be submitted with this application.

No work is to be back filled until American Water has inspected the work.

No actual water or sewer taps into the AWE system. American Water to provide all actual taps.

Survey showing buildings/ locations of other Utilities to be submitted with permit application.

Work Plan Drawings to be submitted with permit application.

All work plans are to be stamped by a Professional Engineer registered in Virginia (does not apply to service line installation).

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Upon Completion of Work the following **must** be submitted in order to make connection to water or sewer system:

- Pressure Test Record
- Disinfection Record (water)
- Bact T Test Results (water)
- Vacuum Test Record (manholes)

All labor is to be in accordance with Davis Bacon Act

It is the responsibility of the Contractor for all Utility Call Outs.

All work is to be inspected by American Water.

Three day notice for Inspection is required.

Inspection Notice to be given to: AWE Utility Manager at **(571) 339-8088**

It is the responsibility of the Contractor to schedule any re-inspections and payment of re-Inspection Fees

**AW Contact Information, Fort Belvoir:**

Jeff Gard, Utility Manager  
American Water Enterprise.  
jgard@amwater.com

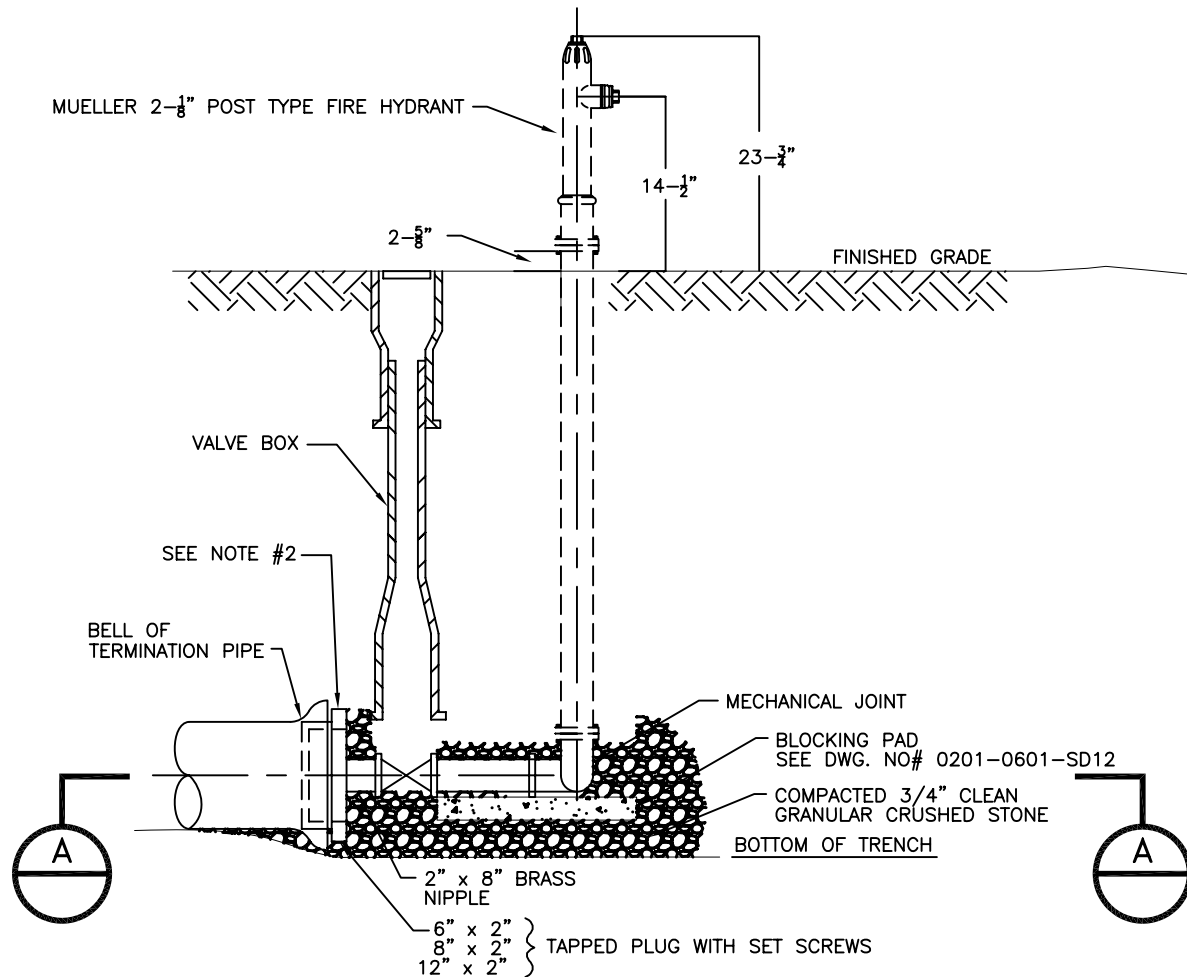
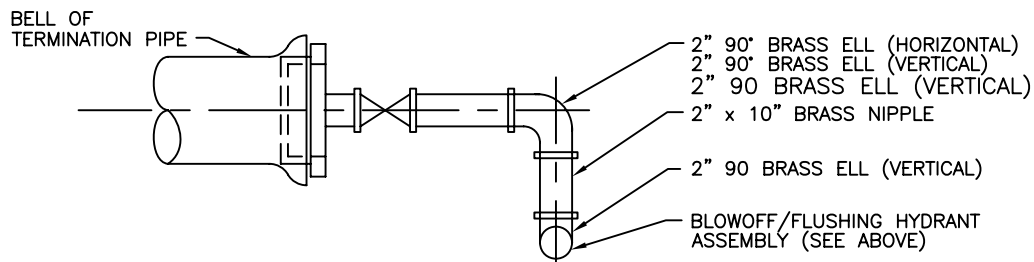
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**For American Water Use only:**

		Date
Required received:	<input type="checkbox"/>	_____
Plans approved and project approved for construction:	<input type="checkbox"/>	_____
Permit Received:	<input type="checkbox"/>	_____
Testing results received (water) and meet required standards:	<input type="checkbox"/>	_____
Connection to existing system approved:	<input type="checkbox"/>	_____
As-built plans received:	<input type="checkbox"/>	_____

## Appendix II

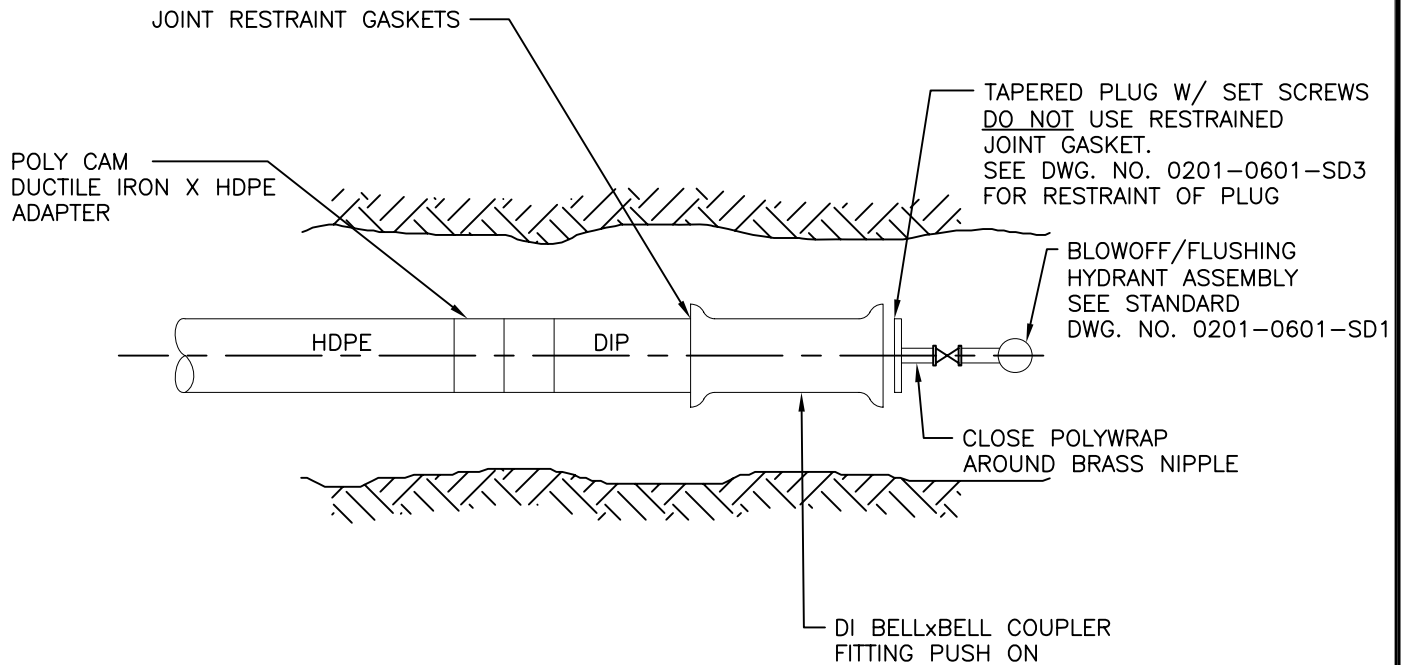
### American Water Detail Sheets

**ELEVATION****SECTION A-A**


## NOTES:

1. POLYETHYLENE ENCASING ON ALL D.I. PIPE.
2. ENCASE OR COAT BRASS AS NEEDED.
3. SEE DWG. NO. 0201-0601-SD3 FOR RESTRAINT OF PLUG.

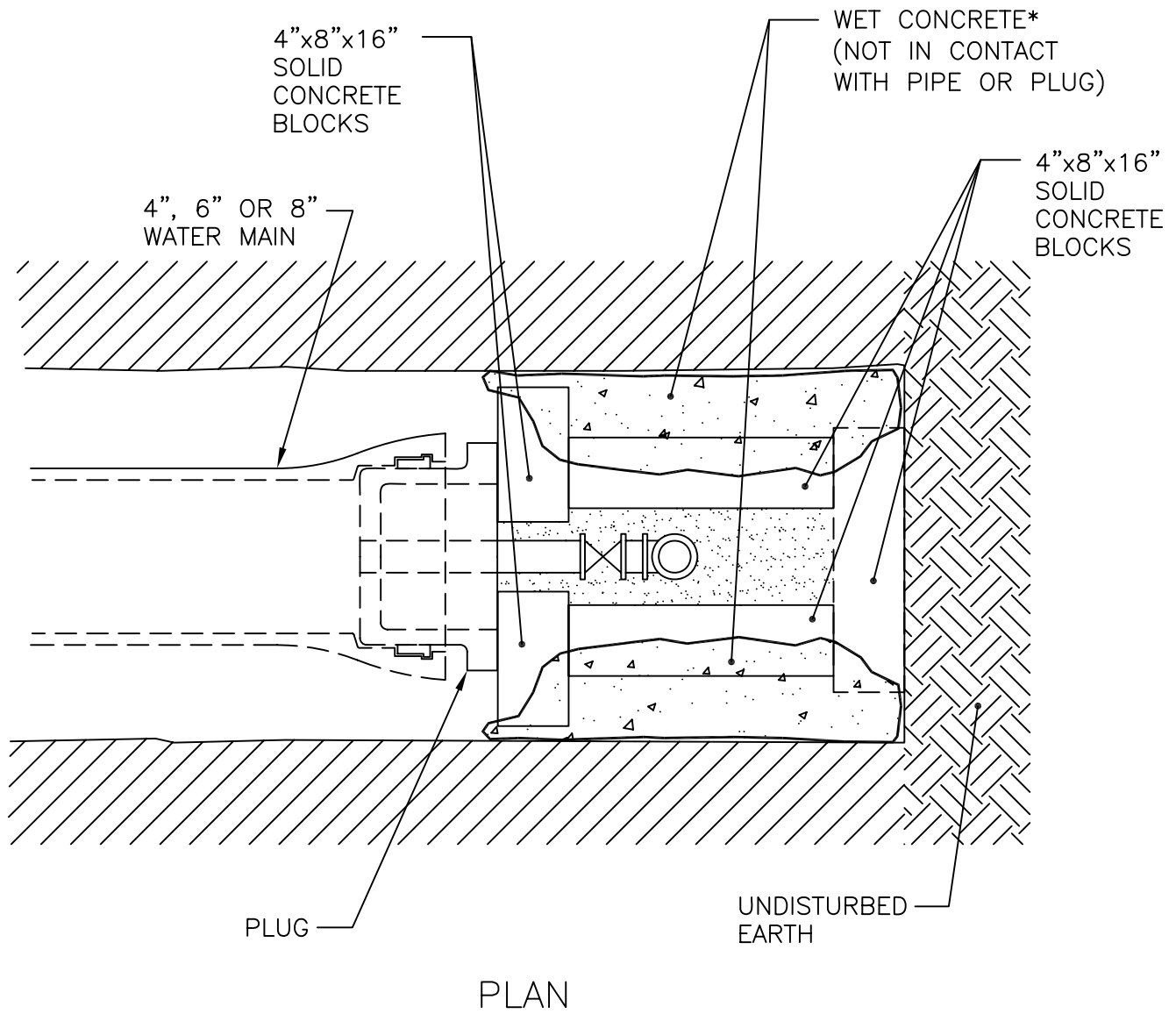
REVISIONS		AMERICAN WATER STANDARD CIVIL BLOWOFF/FLUSHING HYDRANT ASSEMBLY DETAIL	
7/07 - MSG EDITS		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
		DRAWN BY RJB PROJECT ENG'R APPROVED	DATE 08-14-06 PROJECT IP USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD1




PLAN

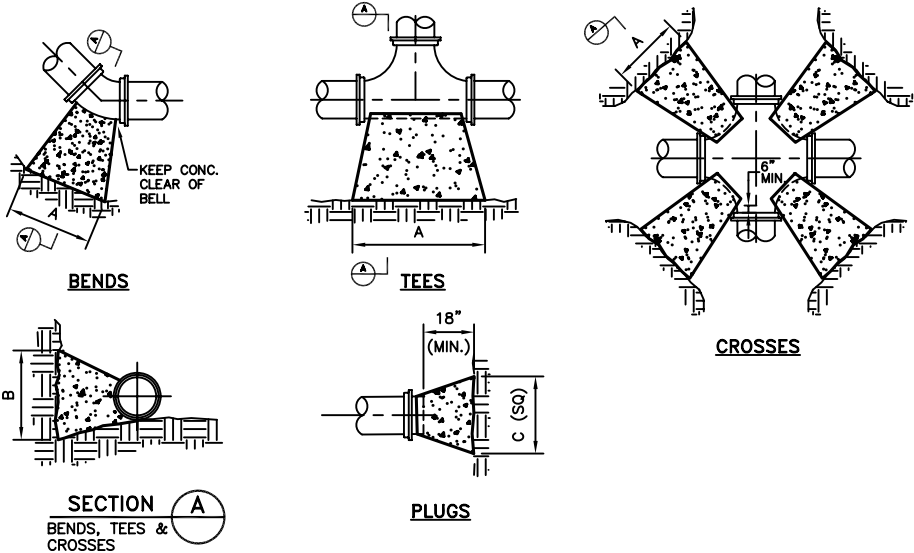
REVISIONS		AMERICAN WATER STANDARD CIVIL HDPE FLUSH VALVE DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
			
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 08–14–06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD2





\* AT DISCRETION OF AW  
PROJECT MANAGER

REVISIONS		AMERICAN WATER STANDARD CIVIL BLOCKING AT END OF MAIN W/BLOW-OFF DETAIL	
7/07 - MSG EDITS		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075 	
		DRAWN BY RJB PROJECT ENG'R APPROVED	DATE 07-31-06 PROJECT IP
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	
		0201-0601-SD3	



- NOTES:**
- 1. COVER OVER TOP OF PIPE SHALL BE BELOW FROST LINE OR 30" MINIMUM, 72" MAXIMUM ACCORDING TO REGULATORY REQUIREMENTS. IF GRADING PLANS RECEIVED BY THE ENGINEER/OWNER WITH THE REQUEST FOR WATER MAIN LAYOUT, INDICATE ADJUSTMENTS TO EXISTING GRADE, THEN PIPE SHALL BE INSTALLED TO MEET MINIMUM AND MAXIMUM COVER FROM PROPOSED GRADES SHOWN ON SAID PLANS.
  - 2. THRUST BLOCKS SHALL BE BUILT AGAINST UNDISTURBED SOIL WITH ADEQUATE BACKING TO PREVENT MOVEMENT OF FITTING.
  - 3. NO THRUST BLOCKS TO BE PLACED IN SEWER LATERAL DITCHES.
  - 4. THRUST BLOCKING MUST FIT IN EASEMENT, IN SOME CASES ADDITIONAL RESTRAINT MAY BE REQUIRED.
  - 5. BASED IN 150 PSI STATIC PRESSURE PLUS 50 PSI WATER HAMMER AND 2000 PSF SOIL BEARING.
  - 6. POLYETHYLENE ENCASEMENT ON ALL D.I. PIPE AND FITTINGS.
  - 7. PIPE JOINTS AND BOLTS MUST BE ACCESSIBLE.
  - 8. ALLOW SUFFICIENT CLEARANCE BETWEEN CONCRETE AND BOLTS FOR FUTURE MAINTENANCE.
  - 9. ALL ANCHOR BOLTS SHALL BE GALVANIZED STEEL, MINIMUM 1/2" DIAMETER. COAT EXPOSED ROD WITH ASPHALT CEMENT AFTER CONCRETE HAS SET.
  - 10. ALL M.J. AND FLG. FITTINGS TO RECEIVE THRUST BLOCKS SHALL HAVE THE FASTENER AREAS FELT WRAPPED AND TAPED PRIOR TO THE CONCRETE POUR TO ALLOW FUTURE ACCESS TO THE FASTENERS AT THE JOINTS.
  - 11. THRUST BLOCKING DETAILS ARE SHOWN HERE FOR TYPICAL INSTALLATIONS. IN SOME CASES, ADDITIONAL RESTRAINT MAY BE REQUIRED.
  - 12. PORTLAND CEMENT CONCRETE USED FOR THRUST BLOCKS SHALL BE MIN 3000 PSI CONCRETE.
  - 13. FOR UNSTABLE SOIL CONDITIONS, CHECK WITH ENGINEER FOR THRUST BLOCK DIMENSIONS.
  - 14. FOR MAIN SIZES GREATER THAN 16", SEE ENGINEER FOR THRUST BLOCK DIMENSIONS.

REQUIRED BEARING AREA ON UNDISTURBED SOIL AND TYPICAL DIMENSIONS															
SIZE	CROSSES/90° BENDS			45° BENDS			11-1/4° BENDS			22-1/2° BENDS			TEES & PLUGS		
	AREA SQ. FT.	"A"	"B"	AREA SQ. FT.	"A"	"B"	AREA SQ. FT.	"A"	"B"	AREA SQ. FT.	"A"	"B"	AREA SQ. FT.	"A"	"B"
6"	4.0	32"	18"	2.2	18"	16"	0.6	5"	18"	1.1	9"	18"	2.8	23"	18"
8"	7.0	42"	24"	3.8	23"	24"	1.0	6"	24"	2.0	12"	24"	5.0	30"	24"
10"	11.0	53"	30"	6.3	30"	30"	1.6	8"	30"	3.1	15"	30"	8.0	38"	30"
12"	16.1	64"	36"	10.0	40"	36"	2.2	9"	36"	4.4	18"	36"	11.3	45"	36"
14"	21.6	74"	42"	12.5	43"	42"	3.0	10"	42"	6.0	21"	42"	15.5	53"	42"
16"	28.3	85"	48"	17.7	53"	48"	4.0	12"	48"	7.7	23"	48"	20.1	60"	48"

\* SURFACE AREA OF BEARING SOIL PROVIDED IS FOR 200 PSI MAXIMUM (INCLUDING SURGE) AND 2000 PSF SOIL BEARING. IF PRESSURE IS HIGHER OR SOIL POTENTIALLY LOWER, CONSULT ENGINEER FOR ADJUSTMENTS.

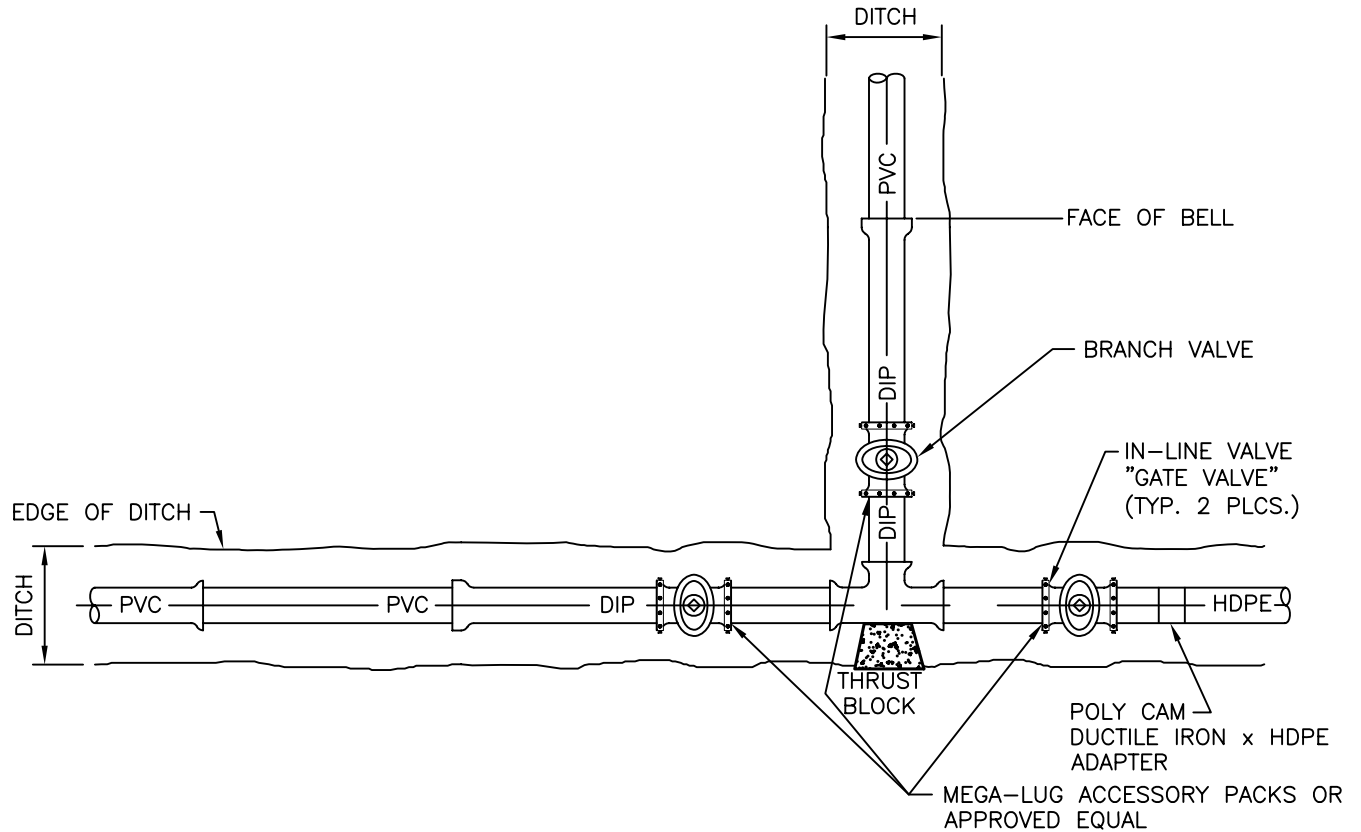
REVISIONS  
7/07 - MSG EDITS


AMERICAN WATER STANDARD  
CIVIL  
THRUST BLOCK  
DETAILS  
AMERICAN WATER  
VOORHEES, NJ 08043  
AMERICAN WATER ENR. CENTER  
215 CARRIDGE LANE  
DELANA, NJ 08075  
DRAWN BY JLB  
PROJECT ENGR APPROVED  
DATE 10-18-08  
PROJECT #  
USE APPROVED DRAWINGS ONLY  
FOR CONSTRUCTION PURPOSES

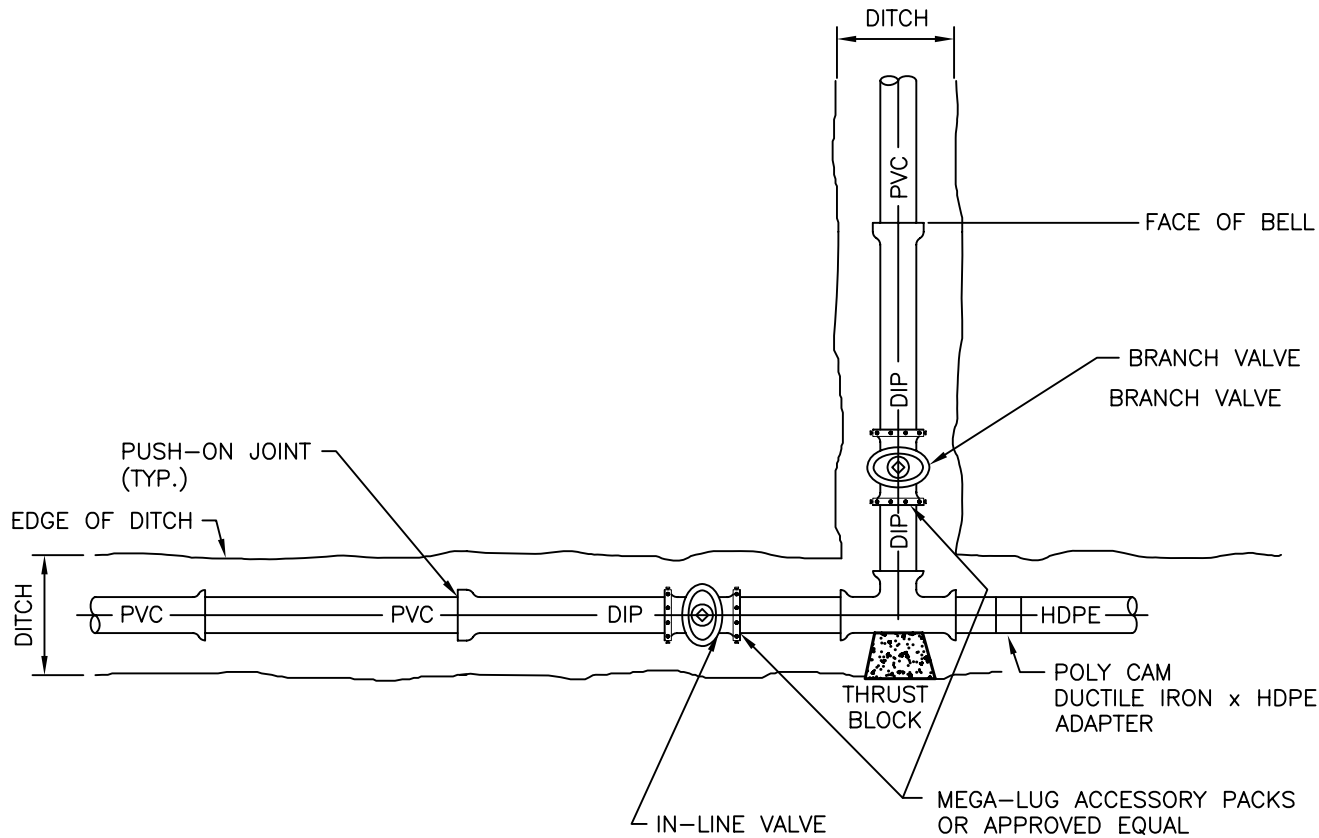
0201-0601-SD6

FINAL

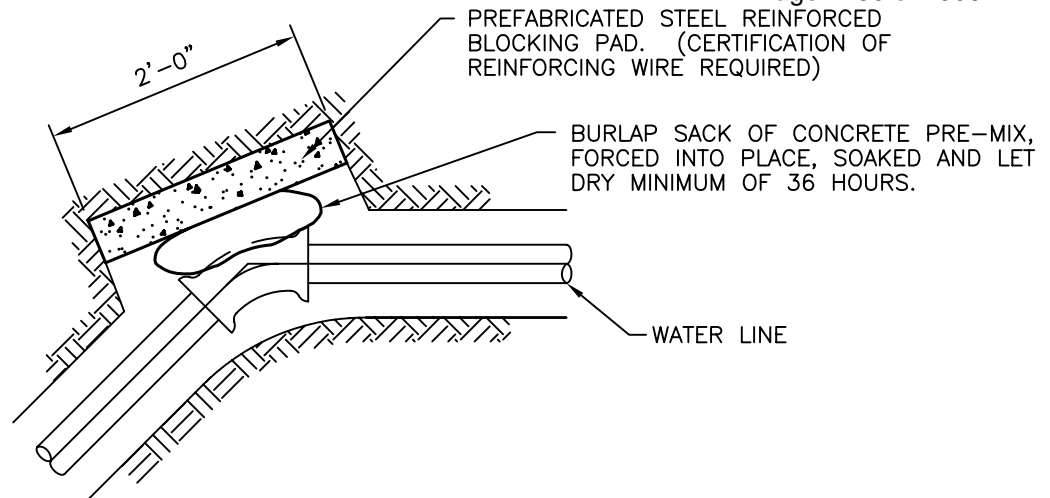
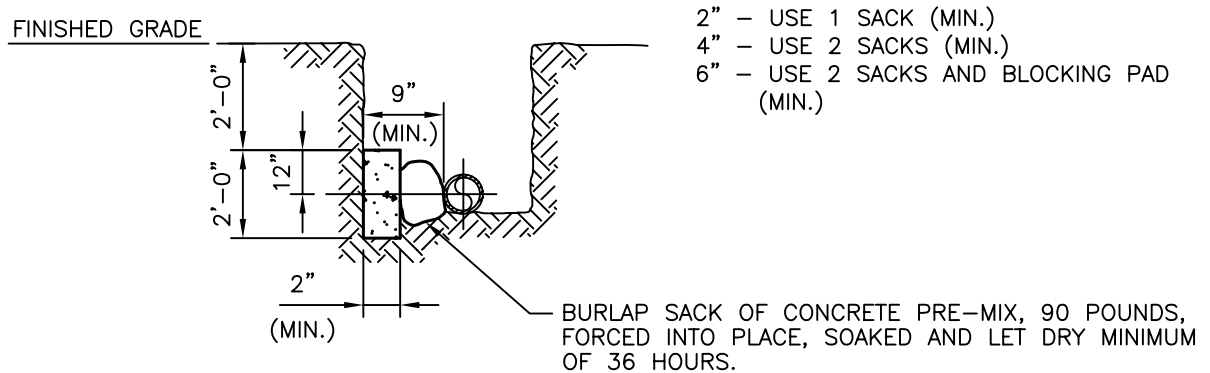
0201-0601-SD6




REVISIONS		AMERICAN WATER STANDARD CIVIL	
7/07 - MSG EDITS		DOUBLE IN-LINE x BRANCH VALVE BLOCKING FOR PVC WATER MAIN - DETAIL	
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
		DRAWN BY RJB PROJECT ENG'R APPROVED	DATE 07-31-06 PROJECT IP USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	
		0201-0601-SD10	

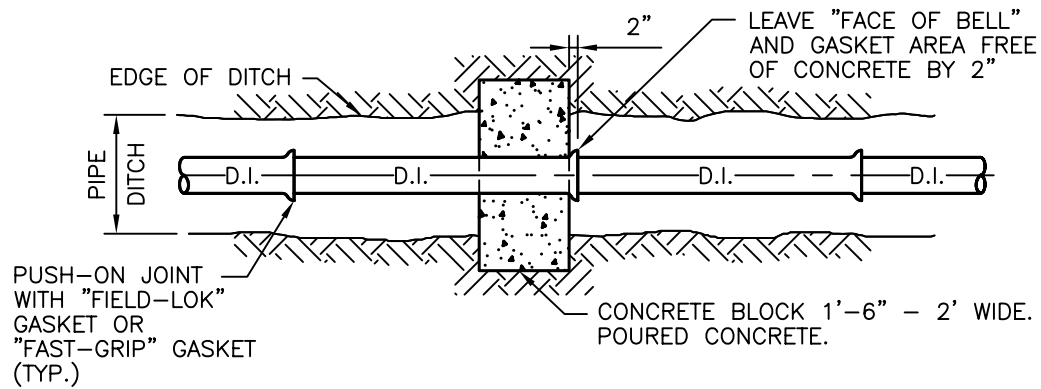


REVISIONS		AMERICAN WATER STANDARD	
7/07 - MSG EDITS		CIVIL	
		IN-LINE x BRANCH VALVE BLOCKING	
		FOR PVC WATER MAIN - DETAIL	
		AMERICAN WATER	
		VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER	
		215 CARRIAGE LANE	
		DELRAN, NJ 08075	
		DRAWN BY RJB	
		PROJECT ENG'R	
		APPROVED	
		DATE 07-31-06	
		PROJECT IP	
		USE DIMENSIONS ONLY	
		SCALE N.T.S.	
		USE APPROVED DRAWINGS ONLY	
		FOR CONSTRUCTION PURPOSES	
		0201-0601-SD11	

PLANELEVATION

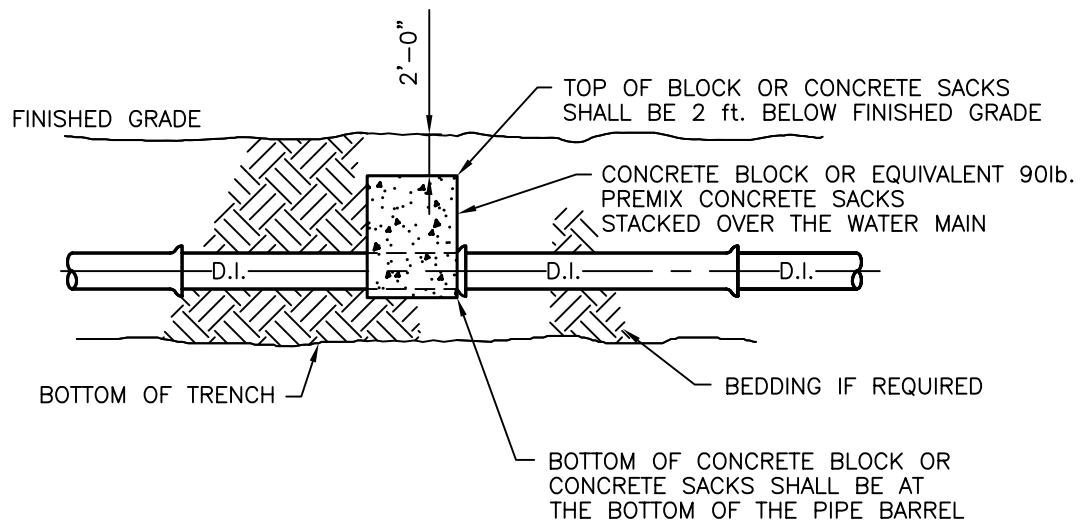
(FOR 2", 4", AND 6" DIA. PIPE ONLY)

REVISIONS		AMERICAN WATER STANDARD CIVIL THRUST BLOCK AT HORIZONTAL BENDS 6" OR LESS – DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
			
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 07–31–06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES		0201–0601–SD17	



DITCH CHECK FOR SLOPES  
GREATER THAN 3.5:1


### PLAN

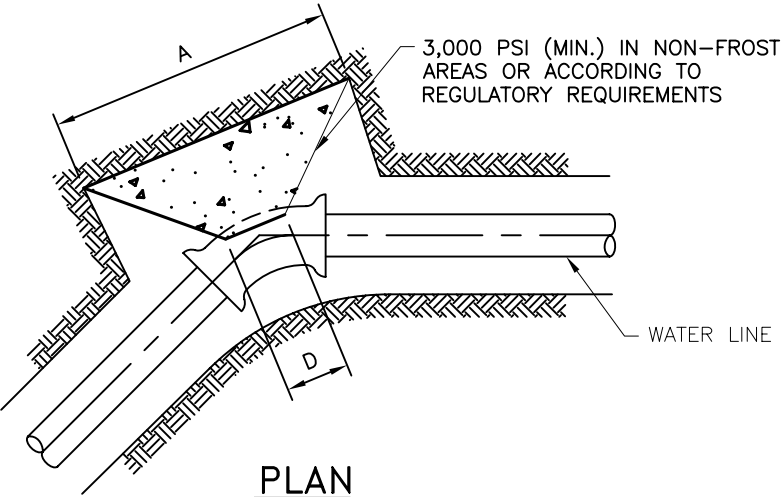


### ELEVATION

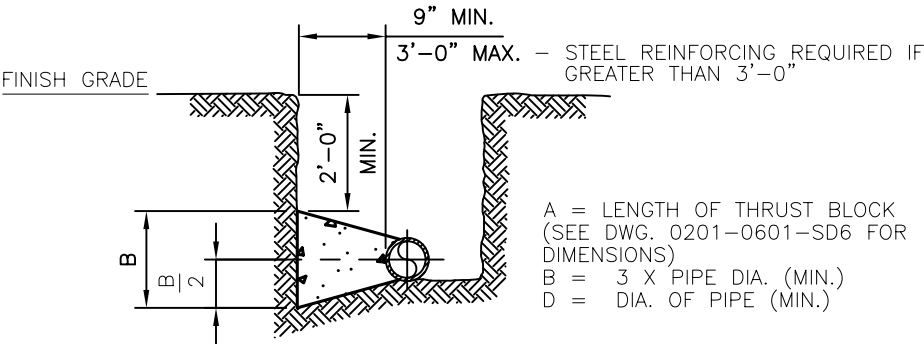
NOTE:

RESTRAINED JOINTS IS THE PREFERRED OPTION

REVISIONS		AMERICAN WATER STANDARD CIVIL DITCH CHECK FOR SLOPES GREATER THAN 3.5:1 – DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	 American Water
		DRAWN BY RJB PROJECT ENG'R APPROVED	DATE 07–31–06 PROJECT IP USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD18



PLAN




ELEVATION

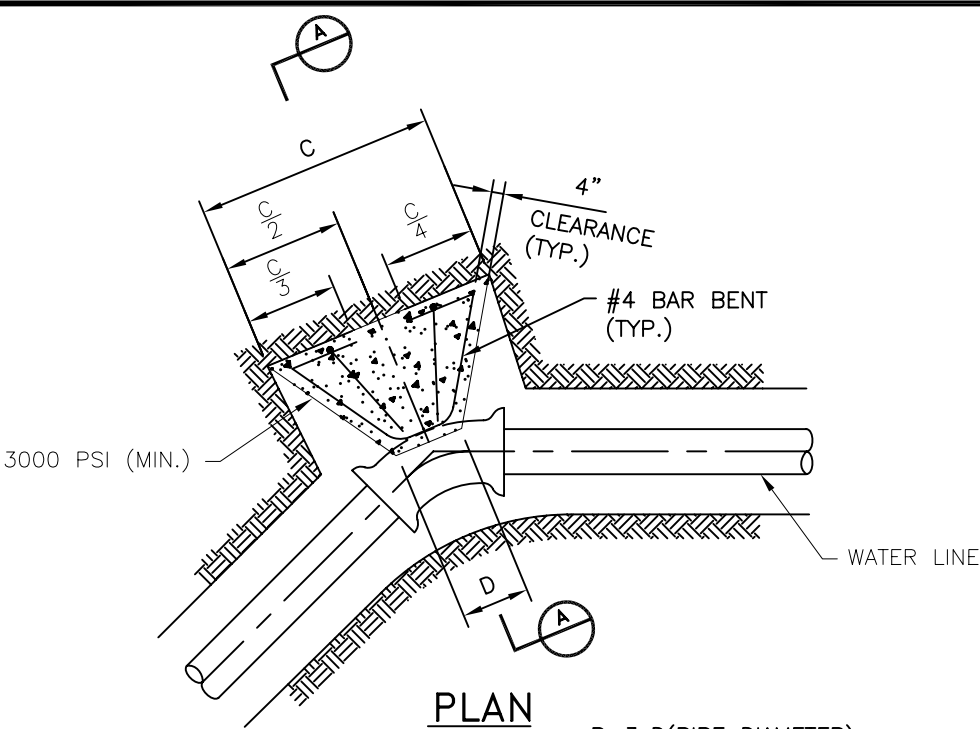
\* BEARING AREAS ARE BASED ON SOIL HAVING AN ALLOWABLE SAFE LATERAL BEARING OF 2000 POUNDS PER SQUARE FOOT AND 200 PSI TEST PRESSURE. AREA MUST BE REVISED FOR SOILS WITH A LOWER BEARING CAPACITY OR HIGHER TEST PRESSURE.

GENERAL NOTES:

1. COVER OVER TOP OF PIPE SHALL BE BELOW FROST LINE MINIMUM 30". IF GRADING PLANS RECEIVED BY THE ENGINEER/OWNER WITH THE REQUEST FOR WATER MAIN LAYOUT, INDICATE ADJUSTMENTS TO EXISTING GRADE, THEN PIPE SHALL BE INSTALLED TO MEET MINIMUM AND MAXIMUM COVER FROM PROPOSED GRADES SHOWN ON SAID PLANS.
2. THRUST BLOCKS SHALL BE BUILT AGAINST UNDISTURBED SOIL WITH ADEQUATE BACKING TO PREVENT MOVEMENT OF FITTING.
3. NO THRUST BLOCKS TO BE PLACED IN SEWER LATERAL DITCHES,.
4. THRUST BLOCKING MUST FIT IN EASEMENT, IN SOME CASES ADDITIONAL RESTRAINT MAY BE REQUIRED.
5. DIMENSION "A" BASED ON MINIMUM BEARING AREA.
6. POLYETHYLENE ENCASEMENT AND MJ FITTINGS WITH RETAINER GLANDS ON ALL D.I. PIPE AND FITTINGS.
7. PIPE JOINTS AND BOLTS MUST BE ACCESSIBLE.
8. ALL ANCHOR BOLTS SHALL BE GALVANIZED STEEL, MINIMUM 1/2" DIAMETER. COAT EXPOSED ROD WITH APPROVED MATERIAL AFTER CONCRETE HAS SET.
9. ALLOW SUFFICIENT CLEARANCE BETWEEN CONCRETE AND BOLTS FOR FUTURE MAINTENANCE.
10. ALL M.J. AND FLG. FITTINGS TO RECEIVE THRUST BLOCKS SHALL HAVE THE FASTENER AREAS KEPT FREE OF CONCRETE TO ALLOW FUTURE ACCESS TO THE FASTENERS AT THE JOINTS.
11. THRUST BLOCKING DETAILS ARE SHOWN HERE FOR TYPICAL INSTALLATIONS. IN SOME CASES, ADDITIONAL RESTRAINT MAY BE REQUIRED.
12. PORTLAND CEMENT CONCRETE USED FOR THRUST BLOCKS SHALL BE 300 PSI CONCRETE (MIN.).

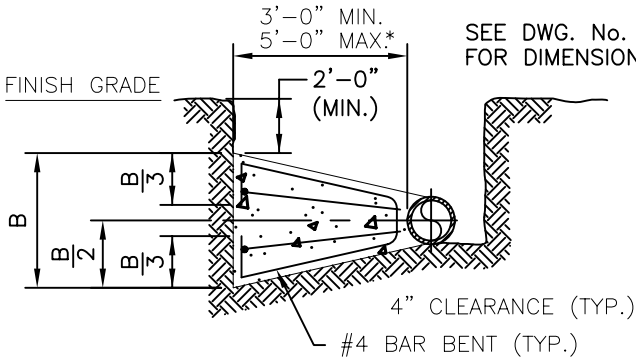
0201-0601-SD19

REVISIONS		AMERICAN WATER STANDARD CIVIL THRUST BLOCK AT HORIZONTAL BENDS (LESS THAN 3 FEET IN THICKNESS)-DETAIL	
7/07 - MSG EDITS		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075 	
		DRAWN BY RJB PROJECT ENG'R APPROVED	DATE 08-01-03 PROJECT IP USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD19



B=3xD(PIPE DIAMETER)

SEE DWG. No. 0201-0601-SD6  
FOR DIMENSIONS



\* SPECIAL DESIGN REQUIRED IF GREATER THAN 5'-0"

SECTION A-A  
N.T.S.

\* BEARING AREAS ARE BASED ON SOIL HAVING AN ALLOWABLE SAFE LATERAL BEARING OF 2000 POUNDS PER SQUARE FOOT AND 200 PSI TEST PRESSURE. AREA MUST BE REVISED FOR SOILS WITH A LOWER BEARING CAPACITY OR HIGHER TEST PRESSURE.

GENERAL NOTES:

1. COVER OVER TOP OF PIPE SHALL BE BELOW FROST LINE OR 30" MINIMUM IN NON-FROST AREAS OR ACCORDING TO REGULATORY REQUIREMENTS. IF GRADING PLANS RECEIVED BY THE ENGINEER/OWNER WITH THE REQUEST FOR WATER MAIN LAYOUT, INDICATE ADJUSTMENTS TO EXISTING GRADE, THEN PIPE SHALL BE INSTALLED TO MEET MINIMUM AND MAXIMUM COVER FROM PROPOSED GRADES SHOWN ON SAID PLANS.
2. THRUST BLOCKS SHALL BE BUILT AGAINST UNDISTURBED SOIL WITH ADEQUATE BACKING TO PREVENT MOVEMENT OF FITTING.
3. NO THRUST BLOCKS TO BE PLACED IN SEWER LATERAL DITCHES,.
4. THRUST BLOCKING MUST FIT IN EASEMENT, IN SOME CASES ADDITIONAL RESTRAINT MAY BE REQUIRED.
5. DIMENSION "C" BASED ON MINIMUM BEARING AREA.
6. POLYETHYLENE ENCASEMENT AND MJ FITTINGS WITH RETAINER GLANDS ON ALL D.I. PIPE AND FITTINGS.
7. PIPE JOINTS AND BOLTS MUST BE ACCESSIBLE.
8. ALL ANCHOR BOLTS SHALL BE GALVANIZED STEEL, MINIMUM 1/2" DIAMETER. COAT EXPOSED ROD WITH APPROVED MATERIAL AFTER CONCRETE HAS SET.
9. ALLOW SUFFICIENT CLEARANCE BETWEEN CONCRETE AND BOLTS FOR FUTURE MAINTENANCE.
10. ALL M.J. AND FLG. FITTINGS TO RECEIVE THRUST BLOCKS SHALL HAVE THE FASTENER AREAS FELT WRAPPED AND TAPED PRIOR TO THE CONCRETE POUR TO ALLOW FUTURE ACCESS TO THE FASTENERS AT THE JOINTS.
11. THRUST BLOCKING DETAILS ARE SHOWN HERE FOR TYPICAL INSTALLATIONS. IN SOME CASES, ADDITIONAL RESTRAINT MAY BE REQUIRED.
12. PORTLAND CEMENT CONCRETE USED FOR THRUST BLOCKS SHALL BE 3000 PSI CONCRETE MINIMUM.

0201-0601-SD20

REVISIONS		AMERICAN WATER STANDARD CIVIL	
7/07 - MSG EDITS		THRUST BLOCK AT HORIZONTAL BENDS (EXCEEDING 3 FT. IN THICKNESS) - DETAIL	
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
		DRAWN BY RJB PROJECT ENG'R RESP. ENGINEER APPROVED	
		DATE 08-01-03 PROJECT IP	
		USE DIMENSIONS ONLY SCALE N.T.S.	
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	
		0201-0601-SD20	



**0201-0601-SD31**

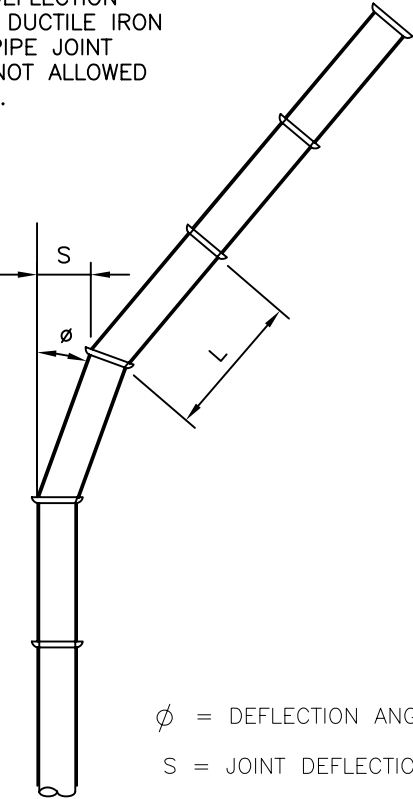
MAXIMUM JOINT DEFLECTION  
FULL-LENGTH PIPE-PUSH-ON TYPE JOINT PIPE

NOMINAL PIPE SIZE INCHES	DEFLECTION ANGLE DEGREES	MAX OFFSET -S INCHES		APPROX RADIUS OF CURVE - R PRODUCED BY SUCCESSION OF INCHES		CURRENT AW DEFLECTION ANGLE DEGREES
		L=18 FT	L=20 FT	L=18 FT	L=20 FT	
3	4	15	17	256	285	
4	4	15	17	256	285	
6	4	15	17	256	285	4
8	4	15	17	256	285	4
10	4	15	17	256	285	
12	4	15	17	256	285	4
14	4	9	10	256	285	
16	2.5	9	10	429	476	2.5
18	2.5	9	10	429	476	
20	2.5	9	10	429	476	2
24	2.5	9	10	429	476	1.5

MJ						
NOMINAL PIPE SIZE  INCHES	DEFLECTION ANGLE	MAX OFFSET -S		APPROX RADIUS OF CURVE - R PRODUCED BY SUCCESSION OF		CURRENT AW DEFLECTION ANGLE
	DEGREES	INCHES		INCHES		DEGREES
		L=18 FT	L=20 FT	L=18 FT	L=20 FT	table deleted
3	6.5	25	28	158	176	
4	6.5	25	28	158	176	
6	5.5	22	24	182	202	
8	4	16	18	256	285	
10	4	16	18	256	285	
12	4	16	18	256	285	
14	3	11	12	367	408	
16	3	11	12	367	408	
18	2.5	11	10	429	476	
20	2.5	9	10	429	476	
24	1.5	9	8	644	715	

Push pipe DI deflection										18	20
angle	18' deflection in inches	20' deflection in inches									
3	5	19	21	205	230	80%	80%	80%	tan angle/2	tan angle/2	
4	5	19	21	205	230	4	15.2	16.8	0.176327	0.140541	256.1533
6	5	19	21	205	230	4	15.2	16.8	0.176327	0.140541	256.1533
8	5	19	21	205	230	4	15.2	16.8	0.176327	0.140541	256.1533
10	5	19	21	205	230	4	15.2	16.8	0.176327	0.140541	256.1533
12	5	19	21	205	230	4	15.2	16.8	0.176327	0.140541	256.1533
14	5	11	12	205	230	4	8.8	9.6	0.176327	0.140541	256.1533
16	3	11	12	340	380	2.4	8.8	9.6	0.1051042	0.083972	428.7126
18	3	11	12	340	380	2.4	8.8	9.6	0.1051042	0.083972	428.7126
20	3	11	12	340	380	2.4	8.8	9.6	0.1051042	0.083972	428.7126
24	3	11	12	340	380	2.4	8.8	9.6	0.1051042	0.083972	428.7126
Push pipe DI deflection										18	20
angle	18' deflection in inches	20' deflection in inches									
3	8	31	35	125	240	80%	80%	80%	tan angle/2	tan angle/2	
4	8	31	35	125	240	6.4	24.8	28	0.2867454	0.227194	158.4546
6	7	27	30	145	160	6.4	24.8	28	0.2867454	0.227194	158.4546
8	5	20	22	195	220	5.6	21.6	24	0.249328	0.198005	181.8133
10	5	20	22	195	220	4	16	17.6	0.176327	0.140541	256.1533
12	5	20	22	195	220	4	16	17.6	0.176327	0.140541	256.1533
14	3.5	13.5	15	285	320	4	16	17.6	0.176327	0.140541	256.1533
16	3.5	13.5	15	285	320	2.8	10.8	12	0.1227846	0.098051	367.1564
18	3	13.5	12	340	380	2.8	10.8	12	0.1227846	0.098051	367.1564
20	3	11	12	340	380	2.4	10.8	9.6	0.1051042	0.083972	428.7126
24	2	11	10	450	500	2.4	8.8	9.6	0.1051042	0.083972	428.7126
						1.6	8.8	8	0.0699268	0.055909	643.9072

- NOTE:
- PIPE JOINT DEFLECTION ALLOWED ON DUCTILE IRON PIPE ONLY. PIPE JOINT DEFLECTION NOT ALLOWED ON PVC PIPE.



$\phi$  = DEFLECTION ANGLE  
S = JOINT DEFLECTION OFFSET  
L = LAYING LENGTH  
R = RADIUS OF CURVE  
 $R = \frac{L}{2 \tan \frac{\phi}{2}}$

NOTE:  
\*L-STANDARD LENGTH OF PIPE SECTION.

0201-0601-SD32

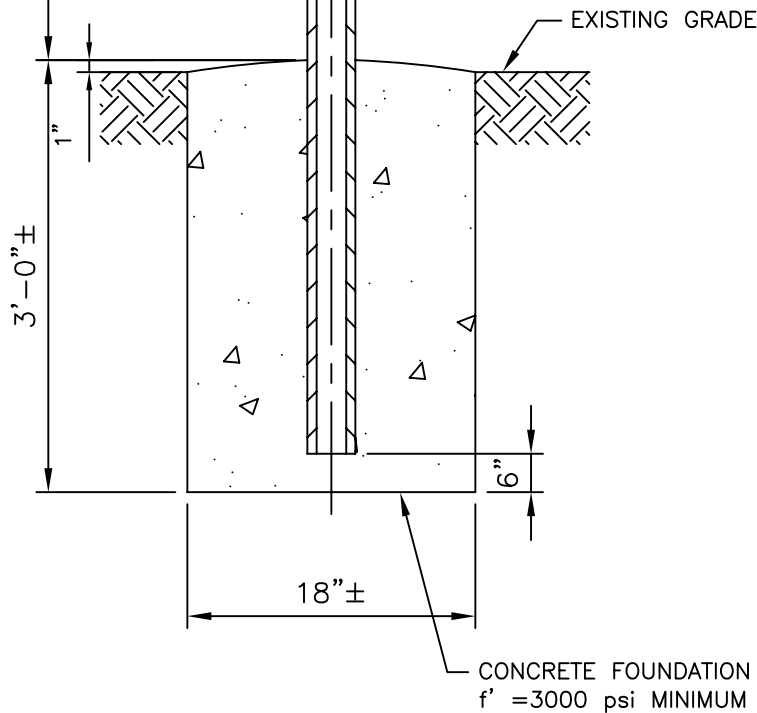
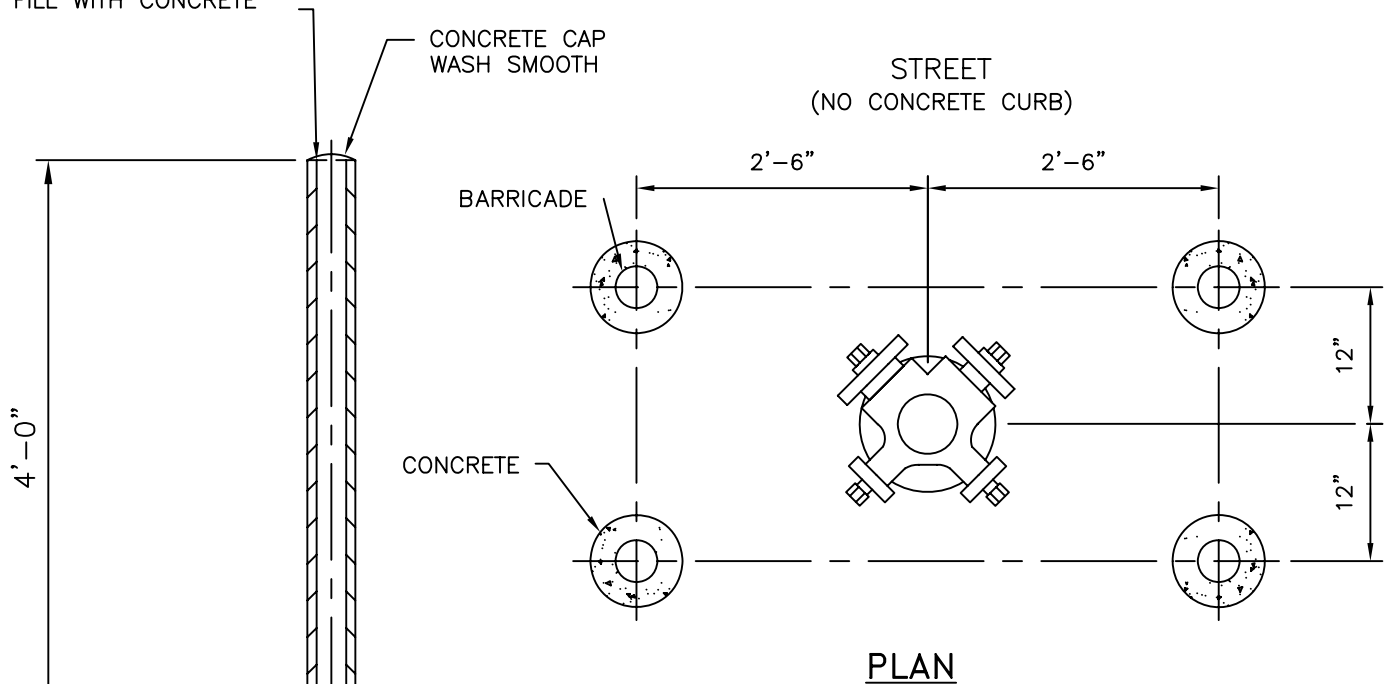
Information Only - Subject to Revision

REVISIONS		AMERICAN WATER STANDARD CIVIL PIPE CURVE GEOMETRY DETAIL	
7/07 - MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
		DRAWN BY RJB PROJECT ENG'R RESP. ENGINEER APPROVED	
		DATE 08-01-03 PROJECT IP	
		USE DIMENSIONS ONLY SCALE N.T.S.	
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	
		0201-0601-SD32	

Section: Appendix II  
 4" SCH. 80 STEEL OR DI PIPE  
 PAINT SAFETY YELLOW (2 COATS)  
 FILL WITH CONCRETE


W912DR-12-R-0017-N/A

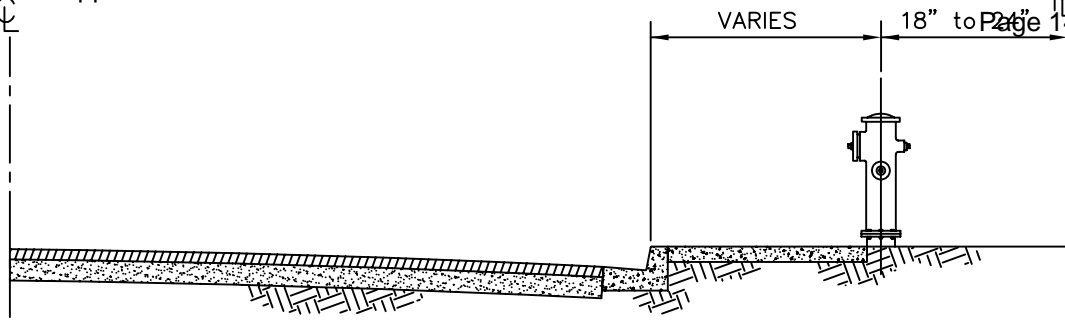
Page 1486 of 1906



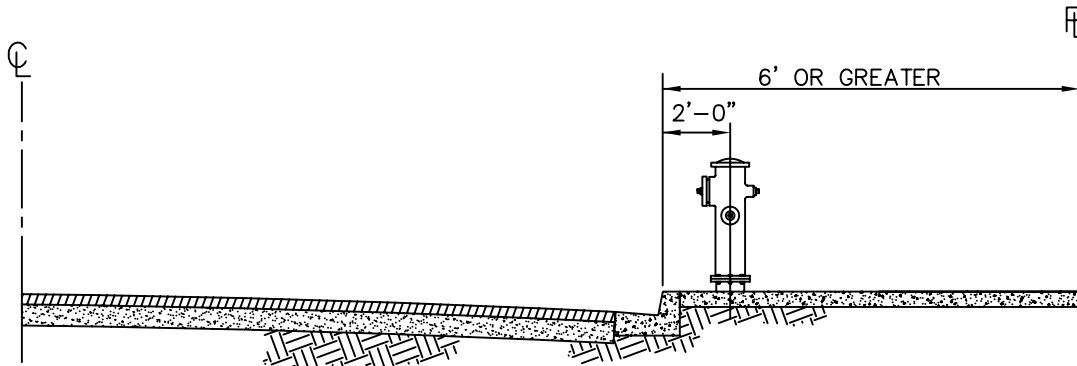
NOTES:

1. SEE PLANS FOR No. OF BARRICADES TO BE USED.
2. THE EXACT LOCATION OF BARRICADES MAY BE CHANGED BY THE ENGR.
3. THE STEEL PIPE ABOVE GROUND SHALL BE PAINTED WITH PRIMER COAT.
4. TWO FINISH COATS OF "SCHOOL BUS YELLOW" SHALL BE USED FOR BARRICADES.
5. BARRICADES FOR FLUSHOUTS, AIR RELEASE VALVES, & VAULT VENTS SHALL BE GIVEN TWO FINISH COATS OF METALLIC GREEN PAINT.
6. DO NOT LOCATE BOLLARD DIRECTLY ABOVE MAIN OR HYDRANT LATERAL.
7. INSURE SUFFICIENT CLEARANCE FOR HYDRANT WRENCH USE.
8. INSURE NO OBSTRUCTION TO ANY NOSSLE ON FIRE HYDRANT.

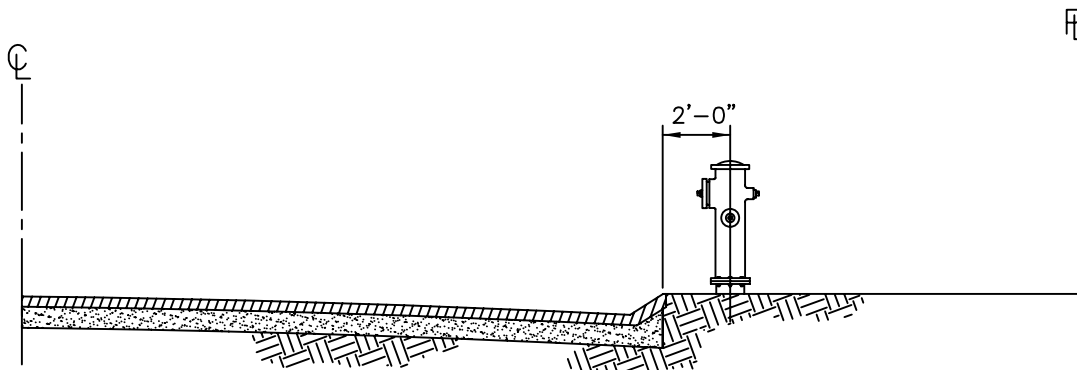
REVISIONS		AMERICAN WATER STANDARD CIVIL FIRE HYDRANT PROTECTION PIPE BOLLARD – DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
			
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 07-31-06 PROJECT IP	USE DIMENSIONS ONLY SCALE 3/4" = 1'-0"
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD34

(CONFORM TO  
LOCAL  
REQUIREMENTS)

CASE 1 WHEN SIDEWALKS ARE ADJACENT TO CURB, HYDRANTS SHALL BE CENTERED AT BACK OF SIDEWALK.




CASE 2 WHEN SIDEWALKS ARE CONSTRUCTED WITH WIDTHS GREATER THAN 6' FROM CURB FACE TO OUTSIDE EDGE OF SIDEWALK HYDRANTS SHALL BE PLACED 24" FROM THE CURB FACE.



CASE 3 WHEN INVERTED SHOULDER SECTION IS PERMITTED AND CURB, GUTTER AND SIDEWALKS ARE WAIVED, THE HYDRANT SHALL BE CENTERED 24" BEHIND THE EDGE OF PAVEMENT.

## NOTES:

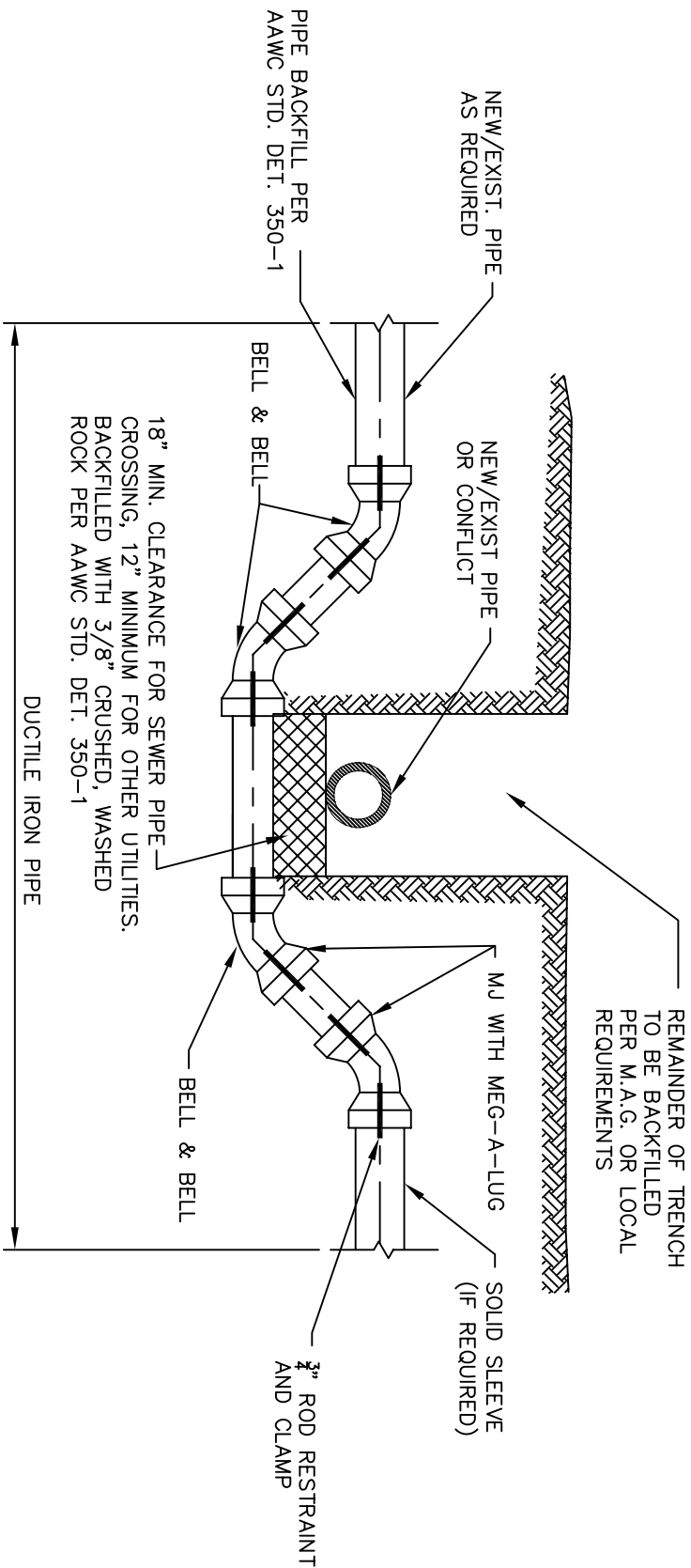
1. REQUIREMENT OF LOCAL AUTHORITY HAVING JURISDICTION SHALL PREVAIL. IN THEIR ABSENCE, THE INSTALLATIONS SHOWN MAY BE USED.
2. EXACT HYDRANT LOCATION TO BE FIELD DETERMINED BY LOCAL AUTHORITY HAVING JURISDICTION.

REVISIONS		AMERICAN WATER STANDARD CIVIL FIRE HYDRANT LOCATION DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		<div>AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075</div> <div> American Water®</div>	
		DRAWN BY RJB PROJECT ENG'R APPROVED	DATE 10-10-06 PROJECT IP
		USE DIMENSIONS ONLY SCALE N.T.S.	
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	
		0201-0601-SD36	

Information Only - Subject to Revision

FINAL

0201-0601-SD36



NOTES:

1. ALL PIPE TO BE JOINT RESTRAINED.
2. PIPE IS TO BE DUCTILE IRON, MINIMUM PRESSURE CLASS 350.
3. ALL DUCTILE IRON PIPE SHALL BE POLYETHYLENE WRAPPED FOR THE ENTIRE LENGTH.
4. BEGIN/END RESTRAINED JOINT STATIONING TO BE SHOWN ON THE APPROVED CONSTRUCTION DRAWINGS. ALL BENDS & FITTINGS SHALL HAVE STATIONING AND ELEVATION SHOWN ON THE APPROVED CONSTRUCTION DRAWINGS. THE BOTTOM ELEVATION OF THE CONFLICT AND THE TOP ELEVATION OF THE DUCTILE IRON PIPE AT THE CENTERLINE OF THE CONFLICT SHALL BE SHOWN ON THE APPROVED CONSTRUCTION DRAWINGS.

REVISIONS  
7/07 - MSG EDITS

AMERICAN WATER STANDARD  
CIVIL  
VERTICAL REALIGNMENT OF WATER MAINS  
DETAIL

AMERICAN WATER  
VOORHEES, NJ 08043

AMERICAN WATER ENG. CENTER  
213 CARRIAGE LANE  
DELRAN, NJ 08075



DRAWN BY RJB  
PROJECT ENG'R RESP. ENGINEER 10-10-06  
APPROVED PROJECT IP  
USE DIMENSIONS ONLY  
SCALE N.T.S.

USE APPROVED DRAWINGS ONLY  
FOR CONSTRUCTION PURPOSES  
0201-0601-SD42

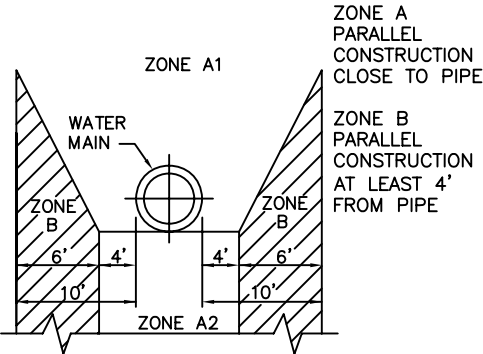
FINAL

0201-0601-SD42

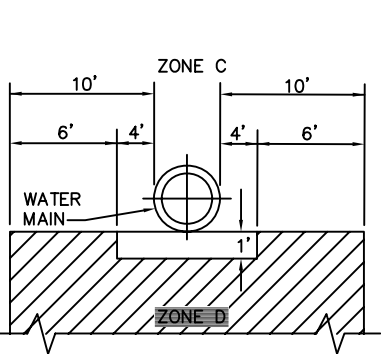
SPECIAL CONSTRUCTION REQUIREMENTS

WHERE REQUIRED WATER MAIN SEPARATION FROM SEWER CANNOT BE MAINTAINED

PARALLEL CONSTRUCTION



PERPENDICULAR CONSTRUCTION



ZONE C PERPENDICULAR ABOVE OR EVEN HORIZONTAL

ZONE D PERPENDICULAR BELOW HORIZONTAL IF AN EXISTING SEWER IS LOCATED WITHIN THESE LIMITS. THE CONDITIONS REQUIREMENTS MAY APPLY (CONFIRM WITH REGULATOR)

REQUIRED SEPARATION BETWEEN WATER MAINS AND SANITARY SEWERS

BASIC SEPARATION REQUIREMENTS:

WATER MAINS AND SEWERS SHOULD BE SEPARATED AS FAR AS IS REASONABLE IN BOTH THE HORIZONTAL AND VERTICAL DIRECTIONS WITH SEWERS LOWER THAN WATER MAINS.

PARALLEL CONSTRUCTION: THE HORIZONTAL DISTANCE BETWEEN PRESSURE WATER MAINS AND SEWERS SHALL BE AT LEAST 10 FEET

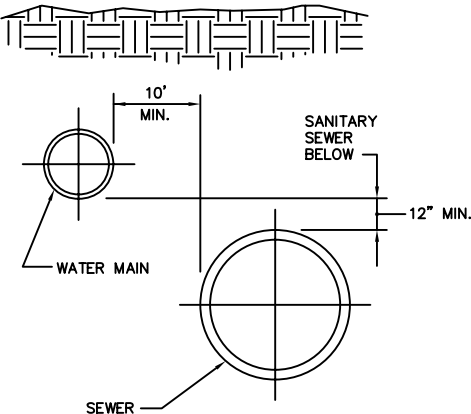
PERPENDICULAR CONSTRUCTION (CROSSING): PRESSURE WATER MAINS SHALL BE AT LEAST 18" ABOVE SANITARY SEWERS WHERE THESE LINES MUST CROSS.

IF AN EXISTING SEWER IS LOCATED WITHIN ZONES A1, A2, B, C, OR D OF A PROPOSED WATER MAIN, THE FOLLOWING SPECIAL REQUIREMENTS APPLY:

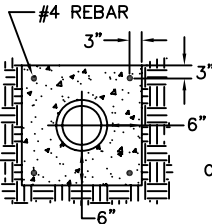
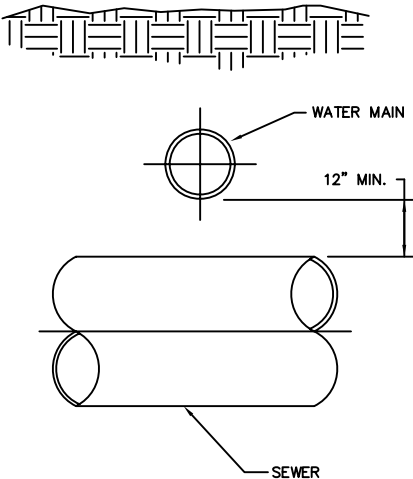
ZONE

- A. NO WATER MAINS SHALL BE CONSTRUCTED WITHOUT SPECIAL PERMISSION FROM THE APPROPRIATE HEALTH OR ENVIRONMENTAL REGULATOR.
- B. IF THE SEWER DOES NOT MEET ZONE B REQUIREMENTS, THE WATER MAIN SHALL BE OF PRESSURE CLASS 200 PIPE FOR PVC AND CLASS 350 FO D.I. PIPE. SEWER SHALL BE CONSTRUCTED EQUAL TO WATER PIPE AND TESTED FOR WATER TIGHTNESS.
- C. NO WATER MAINS SHALL BE CONSTRUCTED WITHOUT SPECIAL PERMISSION FROM THE HEALTH REGULATOR. IF PERMISSION IS GRANTED, THE SEWER PIPE SHALL BE ENCASED WITH REINFORCED CONCRETE AND THE WATER MAIN SHALL BE OF CLASS 200 PIPE OR EQUIVALENT.
- D. THE SEWER SHALL BE ENCASED WITH REINFORCED CONCRETE.

PARALLEL CONSTRUCTION



PERPENDICULAR CONSTRUCTION

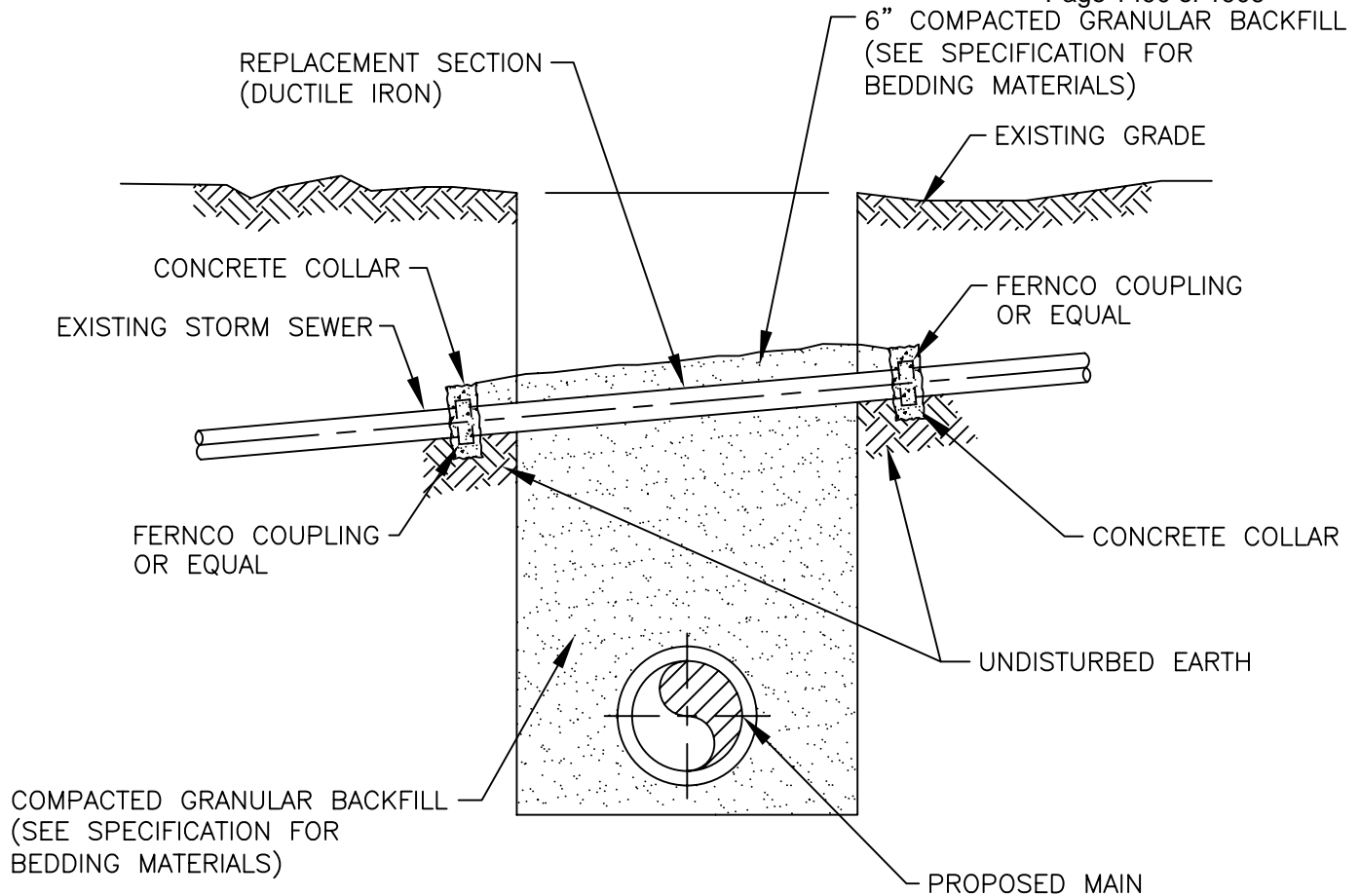


CONCRETE SHALL BE 3000 PSI CONCRETE

REVISIONS		AMERICAN WATER STANDARD	
7/07 - MSG EDITS		CIVIL	
		SPECIAL CONSTRUCTION REQUIREMENTS FOR	
		WATER MAIN - DETAIL	
		AMERICAN WATER	
		VOORHEES, NJ 08043	
		AMERICAN WATER ENL. CENTER	
		315 CARRIAGE LANE	
		BELLEVILLE, NJ 08007	
		DRAWN BY RJB	
		PROJECT ENG'D	
		APPROVED	
		DATE 10-10-06	
		PROJECT #	
		USE APPROVED DIMENSIONS ONLY	
		FOR CONSTRUCTION PURPOSES	
		0201-0601-SD43	

FINAL

0201-0601-SD43



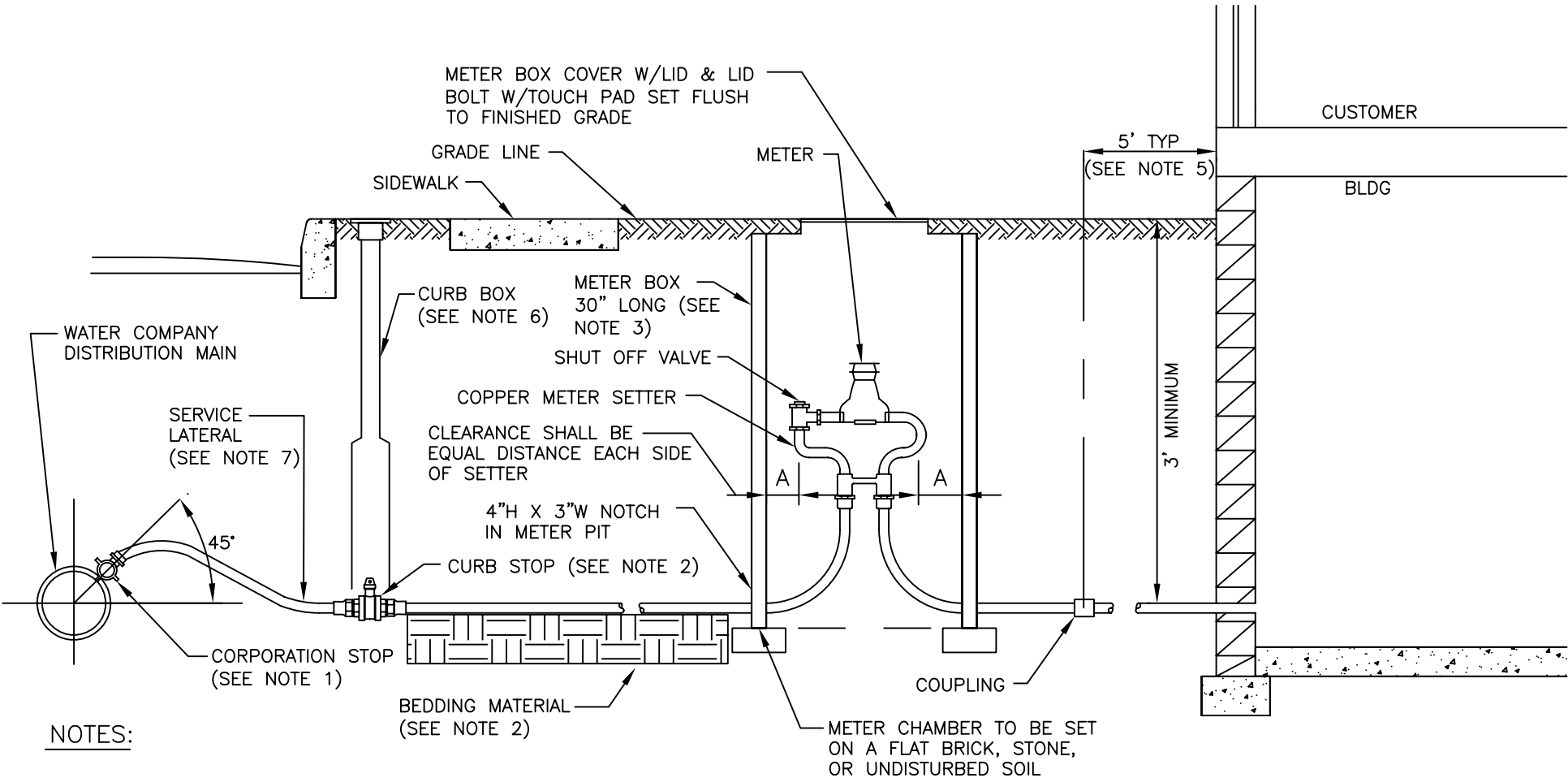
1. IF THE EXISTING STORM SEWER IS DAMAGED OR REMOVED DURING CONSTRUCTION IT SHALL BE REPLACED ACROSS THE TRENCH SUCH THAT THE CONCRETE COLLARS ARE SUPPORTED ON UNDISTURBED EARTH.

2. THE CONCRETE COLLAR SHALL BE FORMED AT A JOINT WITH THE EXISTING HOUSE LATERAL USING FERNCOM COUPLINGS.

3. THE REPLACEMENT SECTION SHALL BE CLASS 350 DUCTILE IRON PIPE WITH AND INSIDE DIAMETER EQUAL TO THE EXISTING PIPE. ANSI/AWWA C151/A21.51 DUCTILE IRON PIPE SHALL BE USED AS A MINIMUM STANDARD.

4. WHEN THE STORM SEWER OWNER HAS REQUIREMENTS WHICH ARE MORE STRINGENT, THE CONTRACTOR SHALL CONFORM TO THE MORE STRINGENT REQUIREMENTS AND MAKE NO CLAIM FOR ADDITIONAL COMPENSATION OR AN EXTENSION OF TIME BECAUSE OF SUCH REQUIREMENTS.

REVISIONS		AMERICAN WATER STANDARD CIVIL STORM SEWER REPLACEMENT DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER WORKS SERVICE COMPANY SYSTEM ENGINEERING	
		AMERICAN WATER WORKS SERVICE COMPANY, INC. SYSTEM ENGINEERING	
		1025 LAUREL OAK RD.	



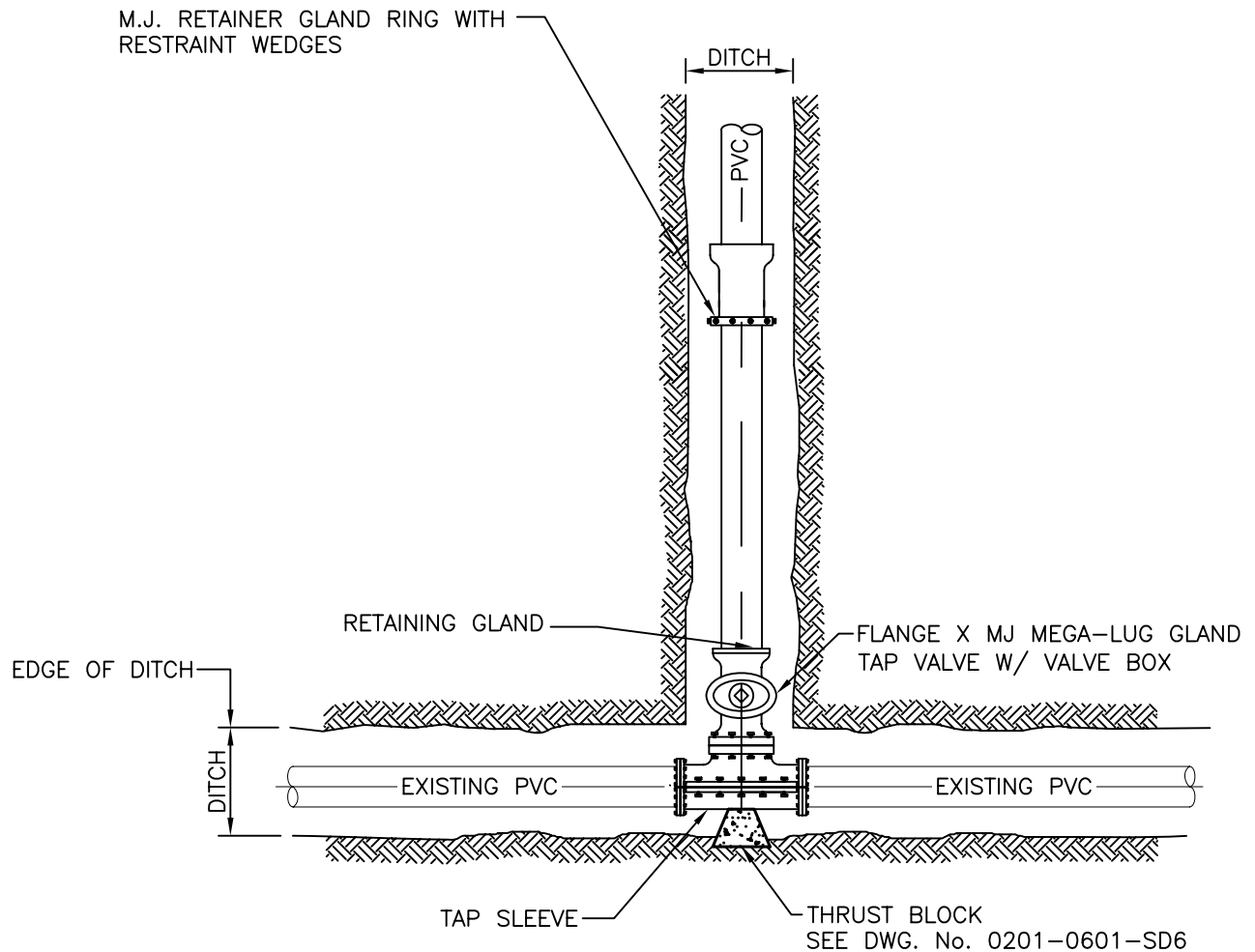
NOTES:

- 1. REFER TO SECTION 02512 PAGE 7 OF SPECIFICATIONS.
- 2. REFER TO SPECIFICATION SECTION 0317, PAGE 11 AND SECTION 02320 FOR BEDDING REQUIREMENTS.
- 3. 18" I.D. CHAMBER FOR USE WITH 5/8" METER. 20" I.D. CHAMBER FOR USE WITH 1" METER. OTHER METER BOX ARRANGEMENTS AS APPROVED BY AW.
- 4. METER BOX LOCATION (IF APPLICABLE) TO BE DETERMINED BY AW.
- 5. POINT OF DEMARCATION FOR SERVICE LINE OWNERSHIP PER PRIME CONTRACT BETWEEN AW AND GOVERNMENT.
- 6. CONFIRM LOCATION OF CURB BOX WITH AW REPRESENTATIVE.
- 7. SERVICE LINE MATERIAL PER SECTION 02512 OF SPECIFICATIONS.

0201-0601-SD47


REVISIONS		AMERICAN WATER STANDARD CIVIL 2" AND BELOW SERVICE LINE INSTALLATION - DETAIL	
7/07 - MSG EDITS		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 08-01-03 PROJECT IP	
		USE DIMENSIONS ONLY SCALE N.T.S.	
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	
		0201-0601-SD47	

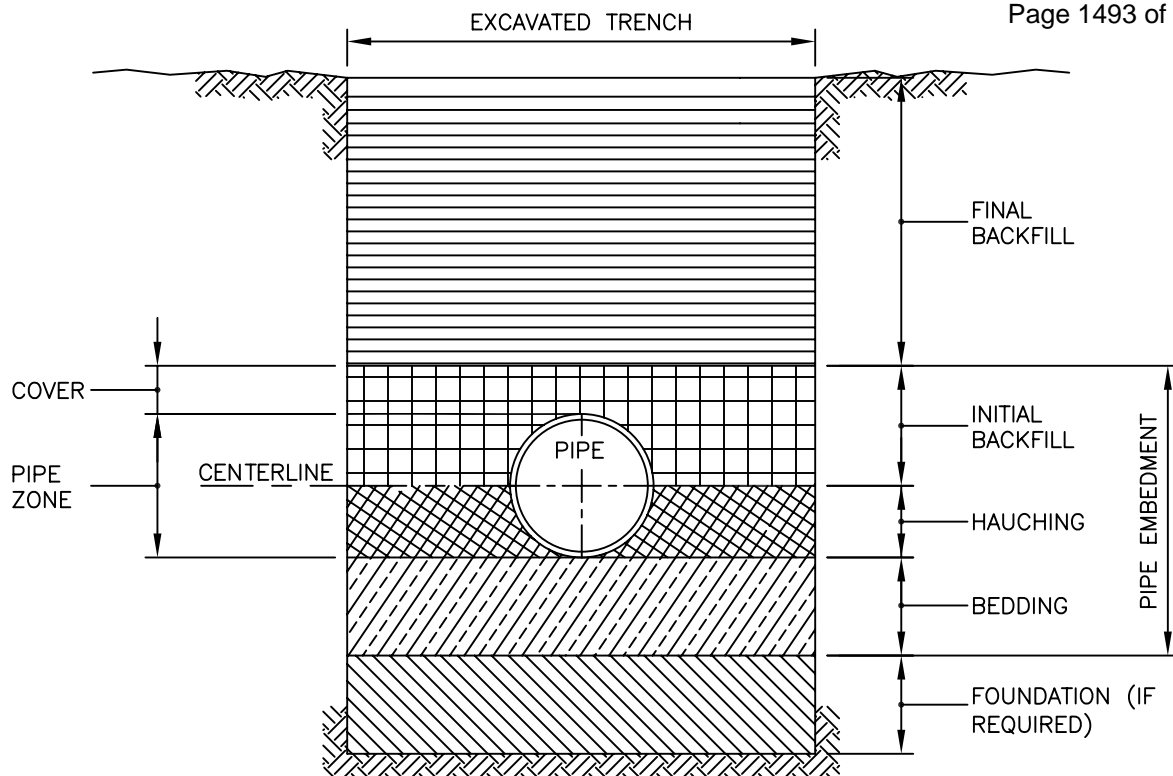




## NOTES:

1. ONE RETAINER GLAND RINGS WITH RESTRAINT WEDGES SHALL BE INSTALLED ON OUTLET SIDE OF TAPPING VALVE.
2. RETAINER GLAND RINGS PER SPECIFICATION.
3. 4" MINIMUM BRANCH SIZE

REVISIONS		AMERICAN WATER STANDARD CIVIL PVC TAP DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
			
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 08-07-06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD49




### TRENCH TERMINOLOGY

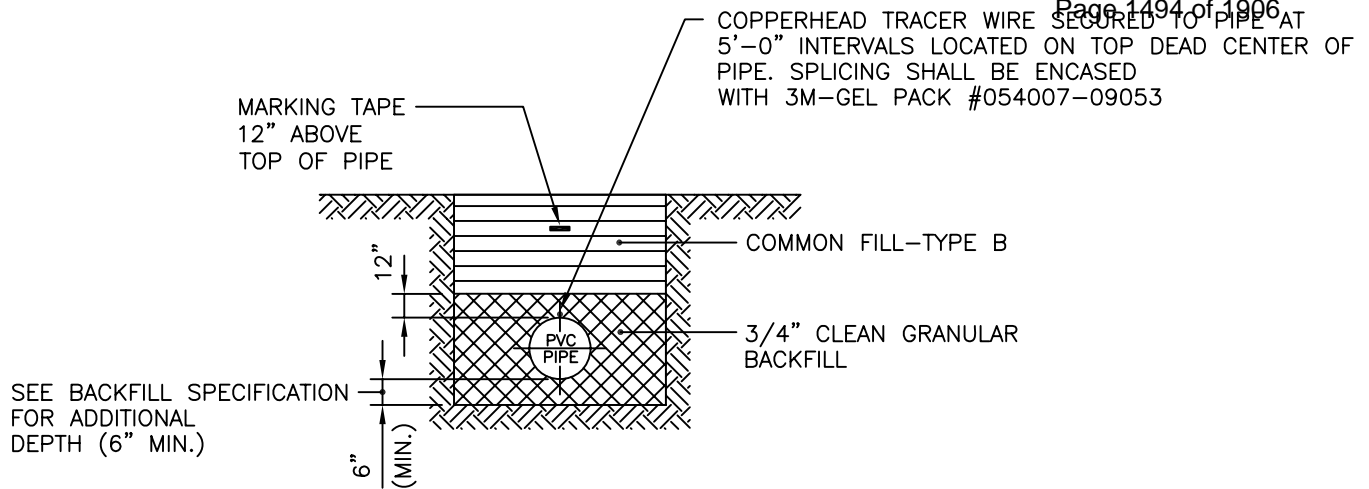
**FOUNDATION:** A FOUNDATION IS NECESSARY ONLY WHEN NATIVE SOILS ARE UNSTABLE. FOR SUCH CONDITIONS, THE TRENCH IS OVER-EXCAVATED AND A LAYER OF SUPPORTIVE MATERIAL IS PLACED AND COMPACTED TO PROVIDE A FIRM FOUNDATION FOR THE SUBSEQUENT PIPE EMBEDMENT MATERIALS.

**EMBEDMENT:** THIS ZONE IS THE MOST IMPORTANT IN TERMS OF PIPE PERFORMANCE. IT IS DIVIDED INTO THE FOLLOWING SUB ZONES:

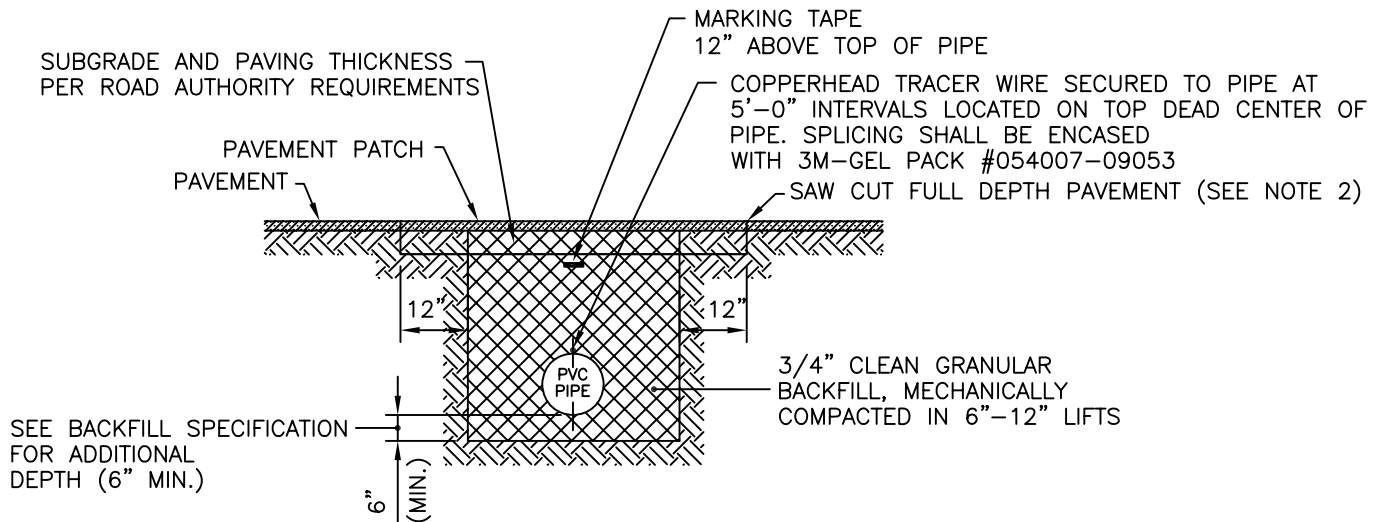
- **BEDDING:** TYPICALLY FOUR TO SIX INCHES OF SUPPORTIVE, COMPACTED MATERIAL. THIS ZONE PROVIDES EVEN SUPPORT FOR THE PIPE AND BRINGS IT TO GRADE.
- **HAUNCHING:** EXTENDS FROM THE BOTTOM OF THE PIPE TO THE CENTERLINE OF THE PIPE. IT PROVIDES THE MOST RESISTANCE TO PIPE DEFLECTION. SPECIFYING PROPER MATERIALS AND COMPACTION ARE MOST IMPORTANT FOR THIS ZONE.
- **INITIAL BACKFILL:** EXTENDS FROM THE SPRINGLINE TO A POINT ABOVE THE TOP OF THE PIPE. THIS ZONE PROVIDES SOME PIPE SUPPORT AND HELPS TO PREVENT DAMAGE TO THE PIPE DURING PLACEMENT OF THE FINAL BACKFILL. THE COVER EXTENDS FROM THE TOP OF THE PIPE TO THE TOP OF THE INITIAL BACKFILL. THE DEPTH OF COVER SHOULD BE AS MUCH AS NECESSARY TO PROTECT THE PIPE DURING PLACEMENT OF THE FINAL BACKFILL. TWELVE INCHES IS A COMMON DEPTH OF COVER.

**FINAL BACKFILL:** THIS ZONE EXTENDS FROM THE TOP OF THE INITIAL BACKFILL TO THE TOP OF THE TRENCH. THIS ZONE HAS LITTLE INFLUENCE ON PIPE PERFORMANCE, BUT CAN BE IMPORTANT TO THE INTEGRITY OF ROADS AND STRUCTURES.

REVISIONS		AMERICAN WATER STANDARD CIVIL PIPE TRENCH TERMINOLOGY DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
			
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 09-22-06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD53

**DETAIL "A"**

PVC - ROCK/SOIL  
(FOR AREAS NOT TO BE PAVED)


**DETAIL "B"**

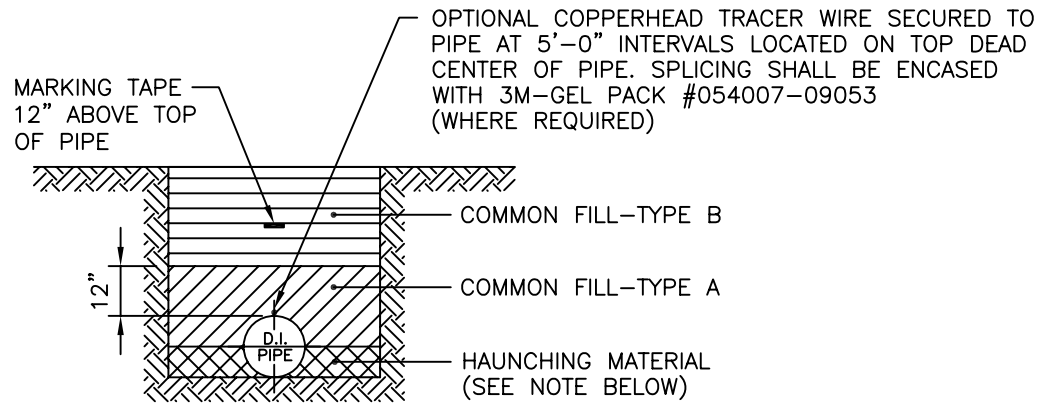
PVC - ROCK/SOIL (FOR PAVED  
AREAS OR AREAS TO BE PAVED OR  
WITHIN 18" OF PAVING)

NOTE: SEE SPECIFICATION SECTIONS  
FOR DESCRIPTION OF BACKFILL AND BEDDING  
MATERIAL.

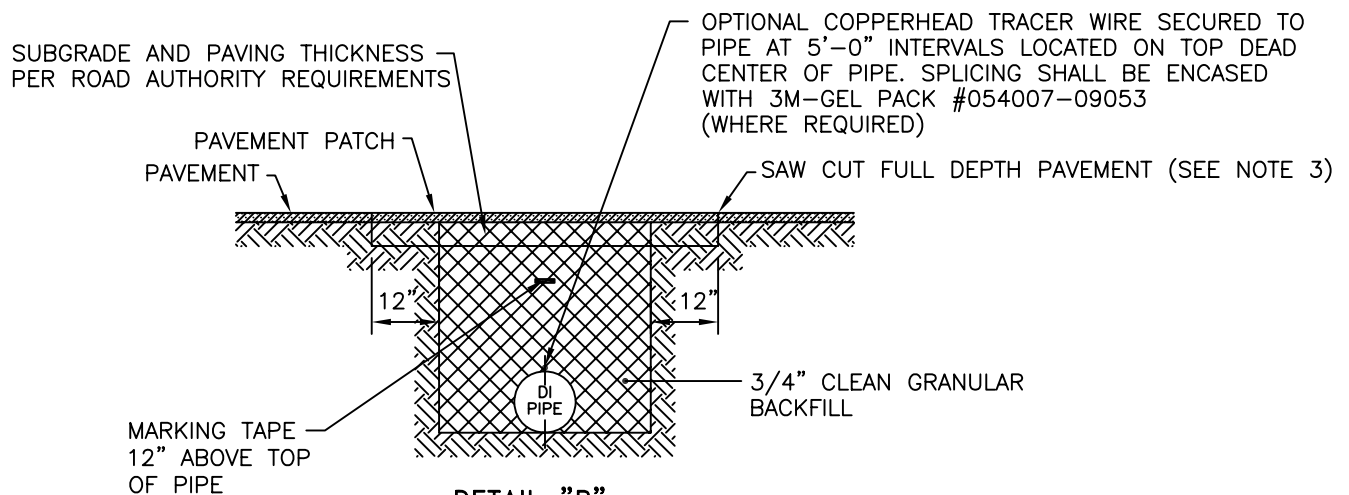
## NOTES:

1. CAUTION MUST BE EXERCISED TO ENSURE PROPER PLACEMENT OF EMBEDMENT MATERIAL UNDER THE HAUNCHES OF THE PIPE.
2. IF EDGE OF SAW CUT IS  $\leq$  4LF FROM CURB LINE, REMOVE PAVEMENT TO CURB

REVISIONS		AMERICAN WATER STANDARD CIVIL TRENCH – PVC PIPE IN ROCK/SOIL DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
			
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 07-31-06 PROJECT IP	
		USE DIMENSIONS ONLY SCALE N.T.S.	
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD54

**DETAIL "A"**

D.I. - SOIL  
(FOR AREAS NOT TO BE PAVED)


**DETAIL "B"**

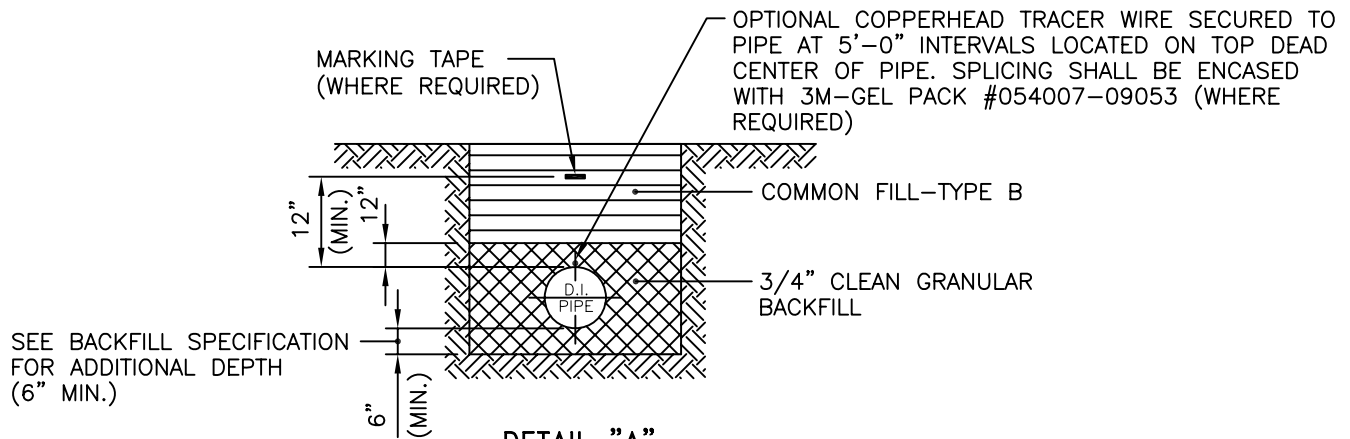
D.I. - SOIL  
(FOR PAVED AREAS OR AREAS TO  
BE PAVED OR WITHIN 18" OF  
PAVING)

NOTE: SEE SPECIFICATION SECTIONS  
FOR DESCRIPTION OF BACKFILL AND BEDDING  
MATERIAL.

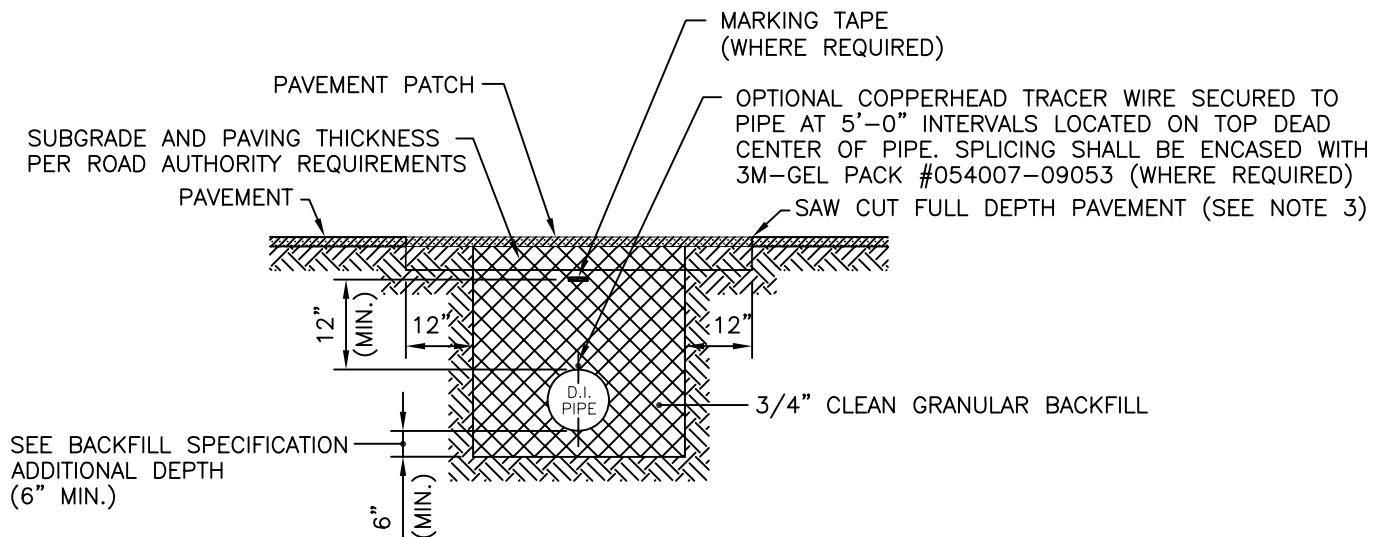
## NOTES:

1. CAUTION MUST BE EXERCISED TO ENSURE PROPER PLACEMENT OF EMBEDMENT MATERIAL UNDER THE HAUNCHES OF THE PIPE.
2. POLYETHYLENE ENCASING ON ALL D.I. PIPE, FITTINGS, VALVES & APPURTENANCES
3. IF EDGE OF SAW CUT IS  $\leq$  4LF FROM CURB LINE, REMOVE PAVEMENT TO CURB

REVISIONS		AMERICAN WATER STANDARD CIVIL TRENCH – D.I. PIPE IN SOIL DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
		 American Water®	
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 07–31–06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201–0601–SD55

**DETAIL "A"**D.I. - ROCK

(FOR AREAS NOT TO BE PAVED)


**DETAIL "B"**D.I. - ROCK

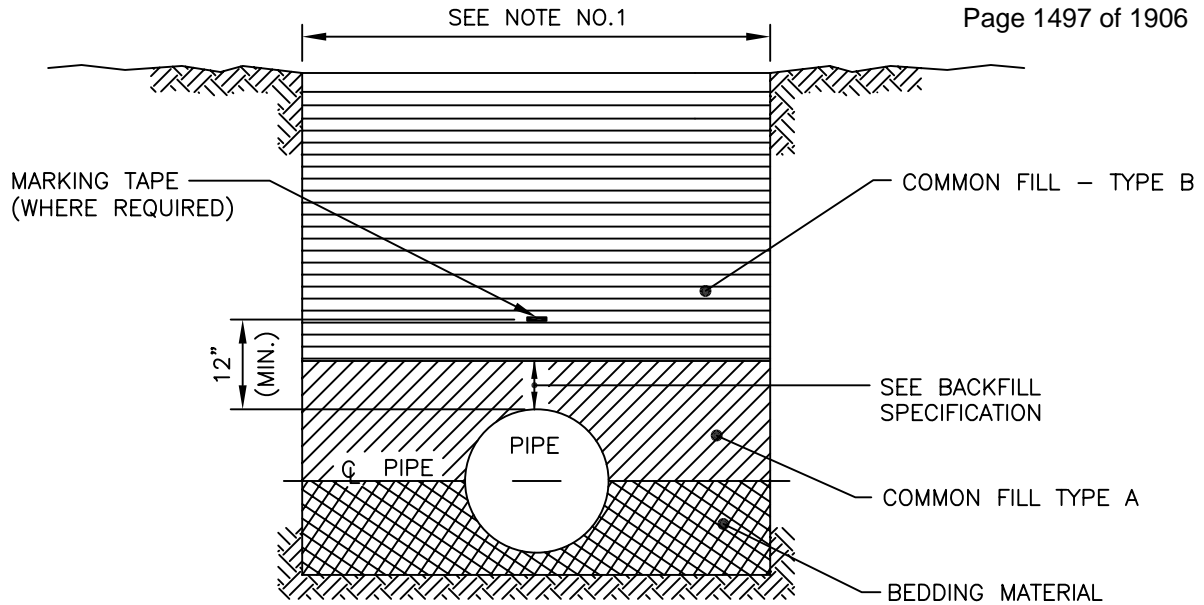
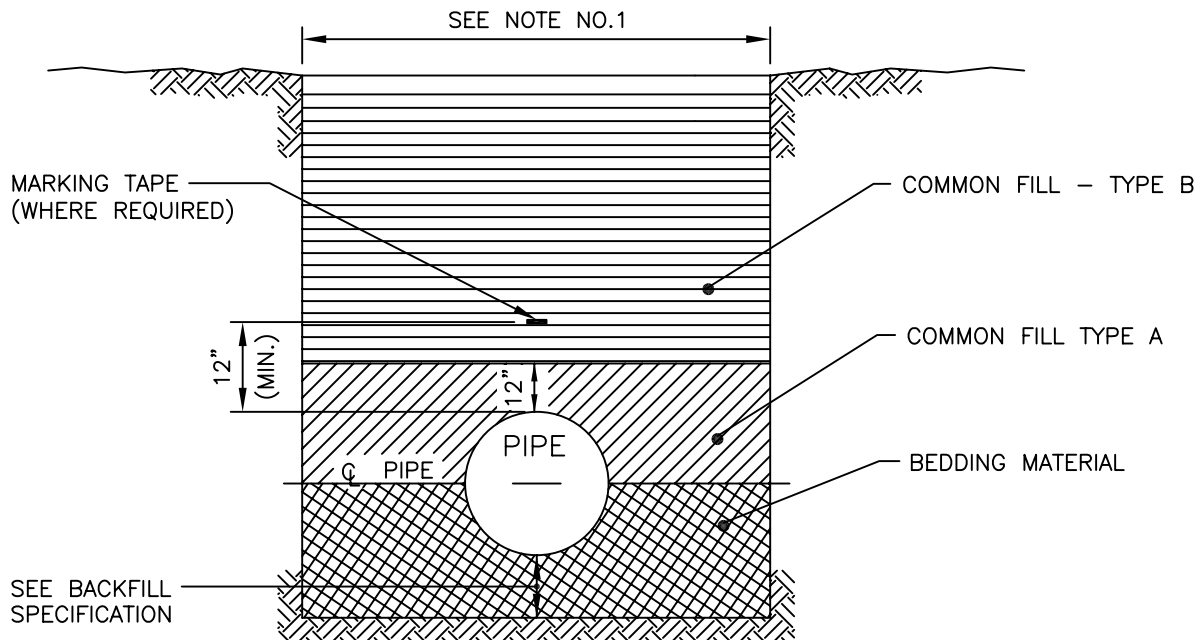
(FOR PAVED AREAS OR AREAS TO BE PAVED OR WITHIN 18" OF PAVING)

NOTE: SEE SPECIFICATION SECTIONS FOR DESCRIPTION OF BACKFILL AND BEDDING MATERIAL.

## NOTES:

1. CAUTION MUST BE EXERCISED TO ENSURE PROPER PLACEMENT OF EMBEDMENT MATERIAL UNDER THE HAUNCHES OF THE PIPE.
2. POLYETHYLENE ENCASING ON ALL D.I. PIPE, FITTINGS, VALVES & APPURTENANCES
3. IF EDGE OF SAW CUT IS  $\leq$  4LF FROM CURB LINE, REMOVE PAVEMENT TO CURB

REVISIONS		AMERICAN WATER STANDARD CIVIL TRENCH – D.I. PIPE IN ROCK DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
			
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 07-31-06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD56

SOILROCK

## NOTE 1:

- IN UPLAND AREAS USE 4" TOPSOIL, SEED, MULCH & FERTILIZE PER SPECIFICATIONS.
- IN WETLAND AREAS, TOP 18" TO BE BACKFILLED WITH NATIVE EXCAVATED SOIL AND REPLANTED WITH NATIVE VEGETATION.
- IN STREAM CHANNELS AND ADJACENT STREAM BANKS, TOP 12" RIP-RAP, VOIDS FILL WITH NATIVE SOIL

NOTE:  
SEE SPECIFICATION SECTIONS  
FOR DESCRIPTION OF BACKFILL  
MATERIAL

## REVISIONS

7/07 - MSG EDITS

AMERICAN WATER STANDARD  
CIVIL  
TRENCH BACKFILL MATERIALS  
UNPAVED AREAS - DETAIL

AMERICAN WATER  
VOORHEES, NJ 08043

AMERICAN WATER ENG. CENTER  
213 CARRIAGE LANE  
DELRAN, NJ 08075



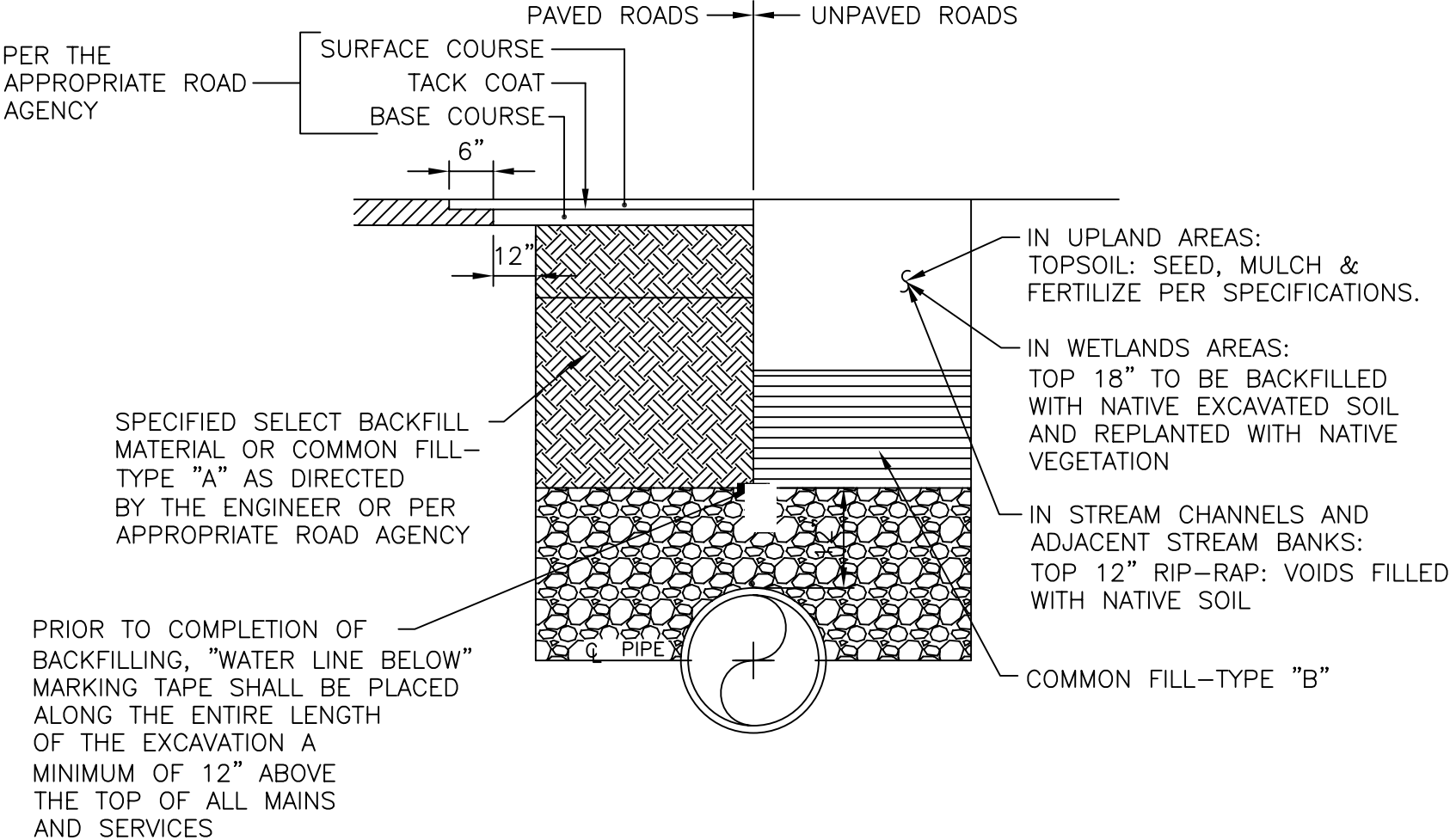
DRAWN BY RJB  
PROJECT ENG'R  
APPROVED

DATE 07-31-06  
PROJECT IP


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SCALE N.T.S.

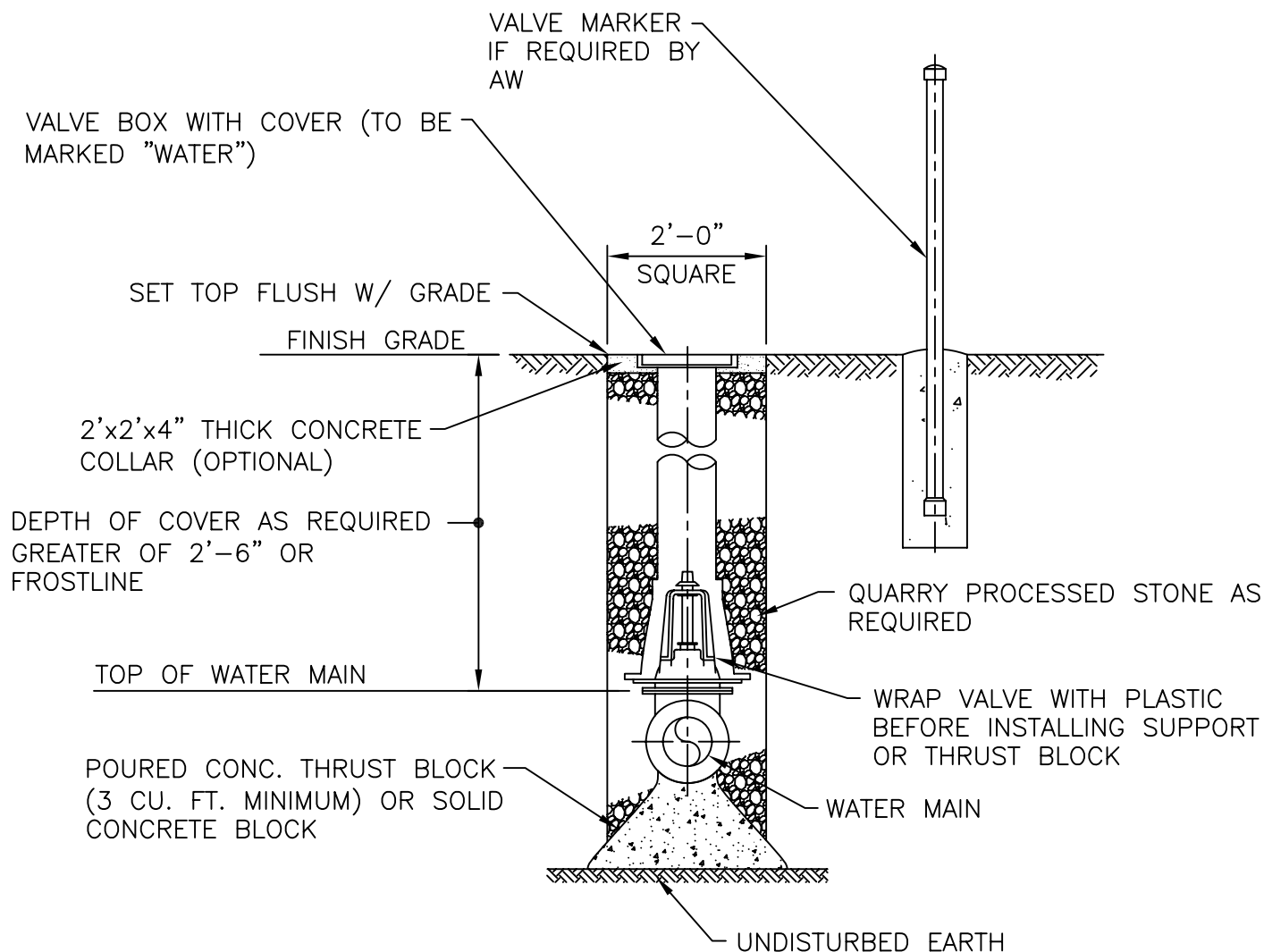
USE APPROVED DRAWINGS ONLY  
FOR CONSTRUCTION PURPOSES

0201-0601-SD57




0201-0601-SD58

REVISIONS		AMERICAN WATER STANDARD CIVIL TRENCH RESTORATION DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		<div>American Water Eng. Center 213 Carriage Lane Delran, NJ 08075</div> <div></div>	
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		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD58

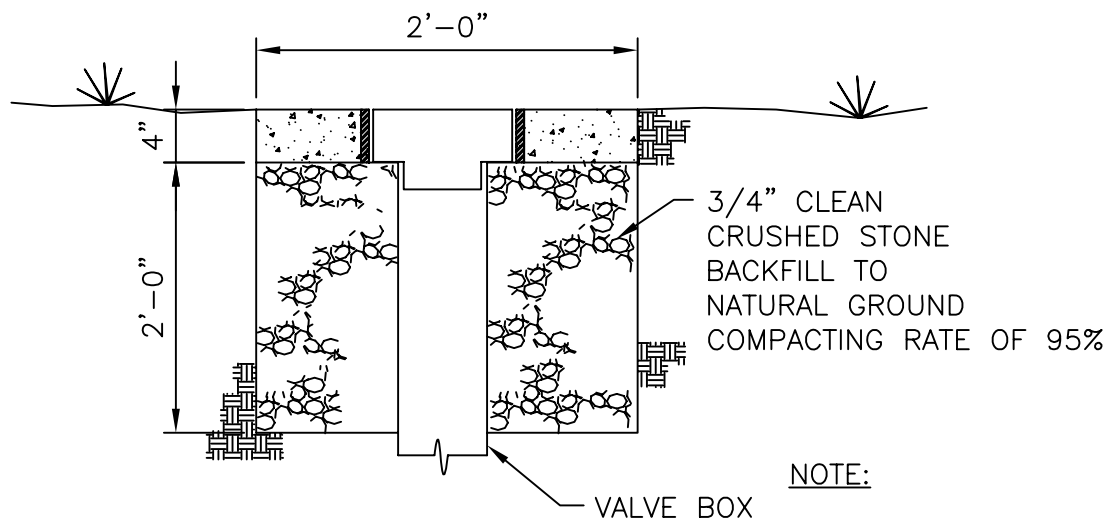
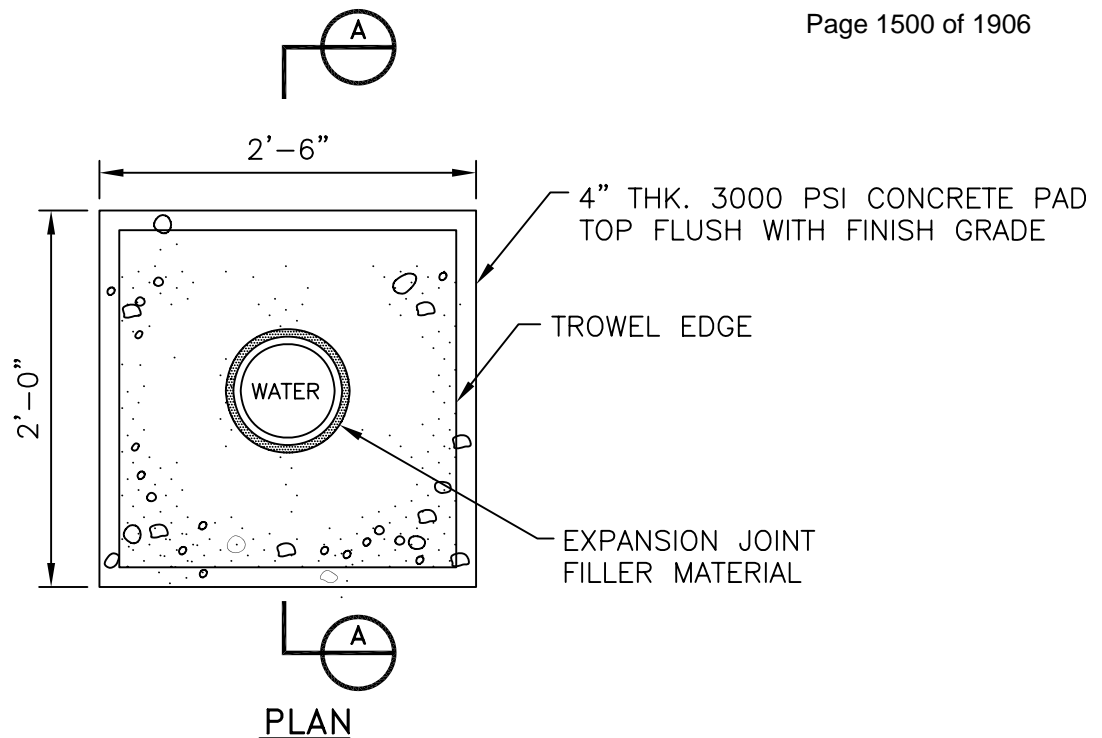


## NOTES:

1. IF PAD IS NOT TO BE  
POURED IMMEDIATELY AFTER  
VALVE BOX INSTALLATION,  
HOLE SHOULD BE  
BACKFILLED TO GRADE WITH  
QUARRY PROCESS STONE
2. INSURE OPERATING NUT IS  
CENTERED IN BOX DURING  
BACKFILL AND AFTER  
COMPACTION

REVISIONS		AMERICAN WATER STANDARD CIVIL VALVE BOX INSTALLATION DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
		 American Water®	
DRAWN BY RJB PROJECT ENG'R APPROVED		DATE 07–31–06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES		0201–0601–SD59	



SECTION A-AVALVE BOX DETAIL  
IN UNPAVED AREAS

N.T.S.

NOTE:

IF PAD IS NOT TO BE POURED  
IMMEDIATELY AFTER VALVE BOX  
INSTALLATION, HOLE SHOULD BE  
BACKFILLED TO GRADE WITH  
3/4" CLEAN CRUSHED STONE  
BACKFILL

## REVISIONS

7/07 - MSG EDITS

AMERICAN WATER STANDARD  
CIVIL  
CONCRETE VALVE BOX PAD  
DETAIL

AMERICAN WATER  
VOORHEES, NJ 08043

AMERICAN WATER ENG. CENTER  
213 CARRIAGE LANE  
DELRAN, NJ 08075



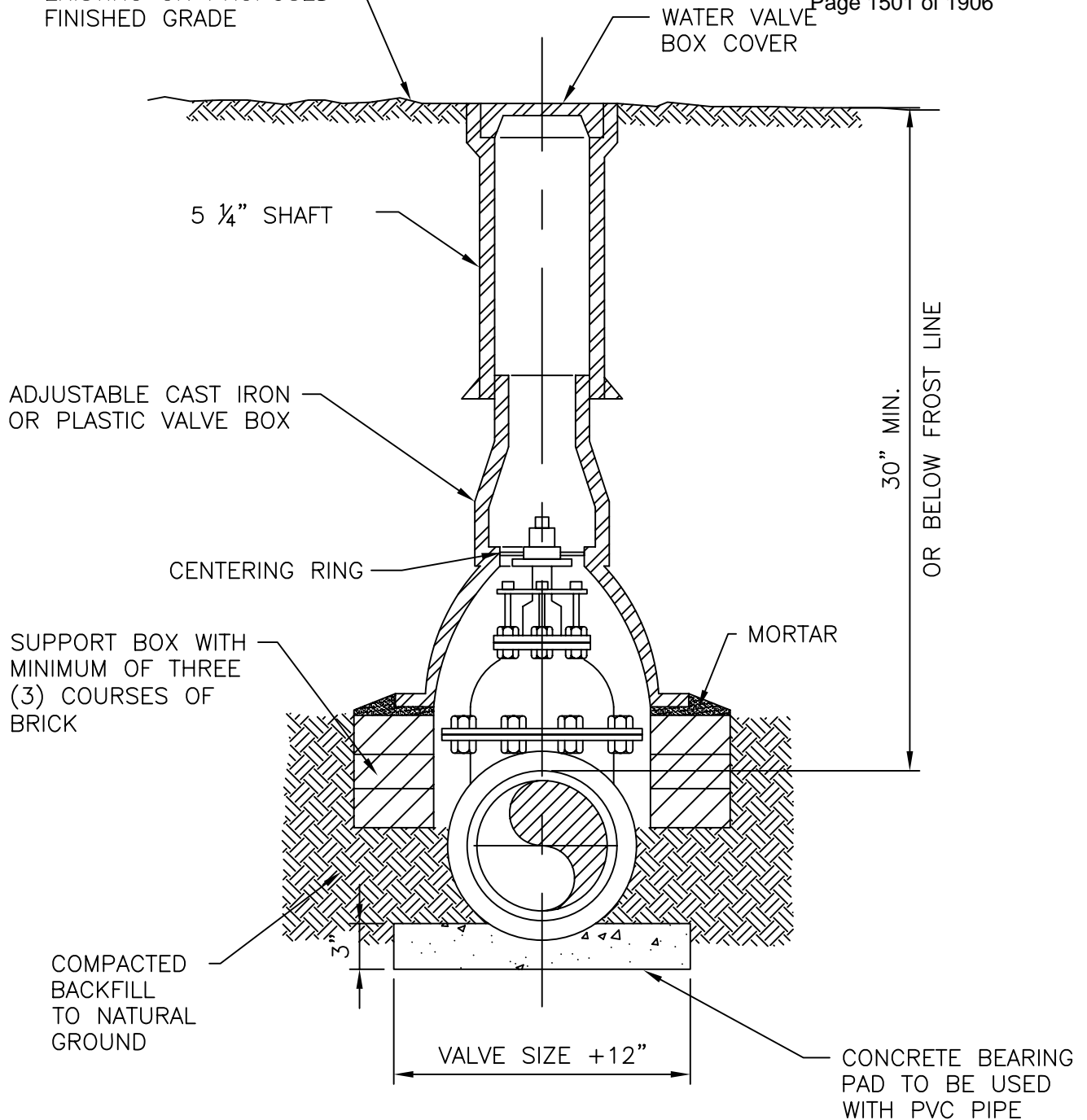
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PROJECT ENG'R  
APPROVED

DATE 07-31-06  
PROJECT IP

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SCALE N.T.S.

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FOR CONSTRUCTION PURPOSES

0201-0601-SD60



## REVISIONS

7/07 - MSG EDITS

AMERICAN WATER STANDARD  
CIVIL  
OPTIONAL VALVE BOX INSTALLATION  
DETAILAMERICAN WATER  
VOORHEES, NJ 08043AMERICAN WATER ENG. CENTER  
213 CARRIAGE LANE  
DELRAN, NJ 08075DRAWN BY RJB  
PROJECT ENG'R  
APPROVEDDATE 07-31-06  
PROJECT IPUSE DIMENSIONS ONLY  
SCALE N.T.S.USE APPROVED DRAWINGS ONLY  
FOR CONSTRUCTION PURPOSES

0201-0601-SD61

LOCKING C.I. MANHOLE FRAME AND COVER IN ACCORDANCE WITH SPECIFICATIONS

WROUGHT IRON BLOW-OFF PIPE WITH MUSHROOM CAP AND BRONZE INSECT SCREEN. (BLOW-OFF PIPE TO BE SAME DIAMETER AS VALVE DISCHARGE ORIFICE)

OPTIONAL MARKER POST

GRADE

4" L ANCHORED TO WALL WITH PLATE AND WEDGE ANCHORS AND U-BOLT VALVE SUPPORT (COAT ALL PARTS WITH COAL TAR EPOXY)

DOUBLE CHK BFP

2" AIR/VACUUM RELEASE VALVE

U-BOLT

CONCRETE VALVE VAULT OF MANHOLE IN ACCORDANCE WITH SPECIFICATIONS

1/2 TON GRAVEL FOR DRAINAGE

2" COPPER TUBING TYPE "K"

2" CORPORATION STOP

BRICK (TYP.)

D.I. WATER MAIN

#### NOTES:

1. THIS TAPPING DETAIL IS FOR D.I. PIPE ONLY. FOR ALL OTHER MATERIALS, SEE TAPPING DETAIL SHEET.

#### REVISIONS

7/07 - MSG EDITS

#### AMERICAN WATER STANDARD CIVIL SHALLOW BURY AIR RELEASE VALVE ASSEMBLY DETAIL

AMERICAN WATER  
VOORHEES, NJ 08043

AMERICAN WATER ENG. CENTER  
213 CARRIAGE LANE  
DELRAN, NJ 08075



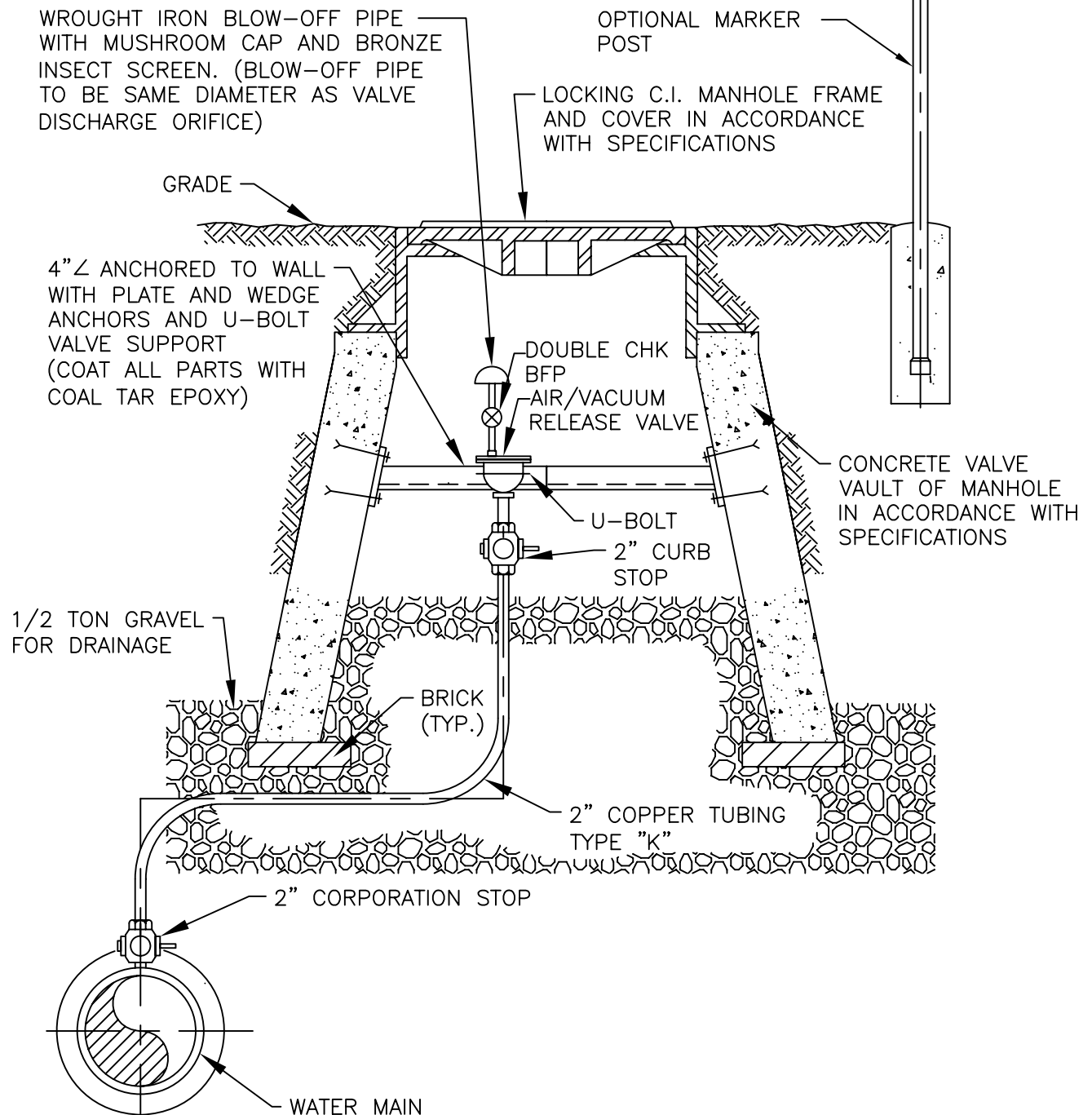
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PROJECT ENG'R  
APPROVED

DATE 07-31-06  
PROJECT IP

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FOR CONSTRUCTION PURPOSES

0201-0601-SD65



## NOTES:

1. THIS TAPPING DETAIL IS FOR D.I. PIPE ONLY. FOR ALL OTHER MATERIALS, SEE TAPPING DETAIL SHEET.

REVISIONS  
7/07 - MSG EDITS

AMERICAN WATER STANDARD  
CIVIL  
DEEP BURY AIR RELEASE VALVE  
ASSEMBLY DETAIL

AMERICAN WATER  
VOORHEES, NJ 08043

AMERICAN WATER ENG. CENTER  
213 CARRIAGE LANE  
DELRAN, NJ 08075



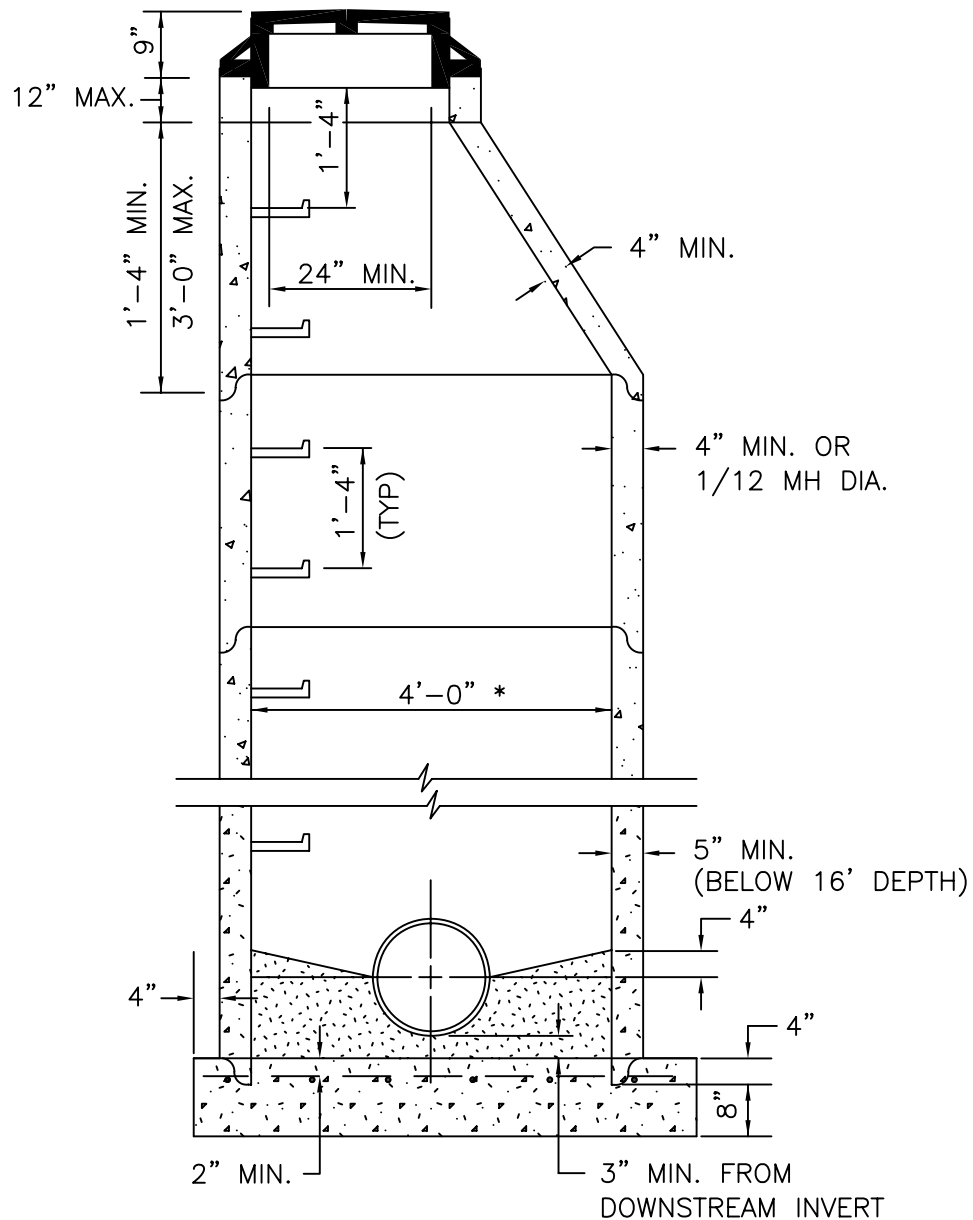
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PROJECT ENG'R  
APPROVED

DATE 07-31-06  
PROJECT IP

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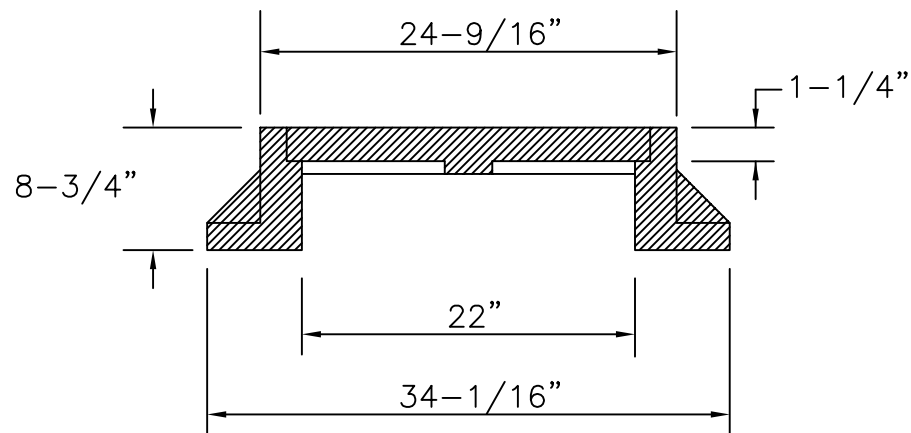
0201-0601-SD66



\* UNLESS OTHERWISE NOTED ON PLANS


## STANDARD PRECAST MANHOLE (ECCENTRIC CONE)

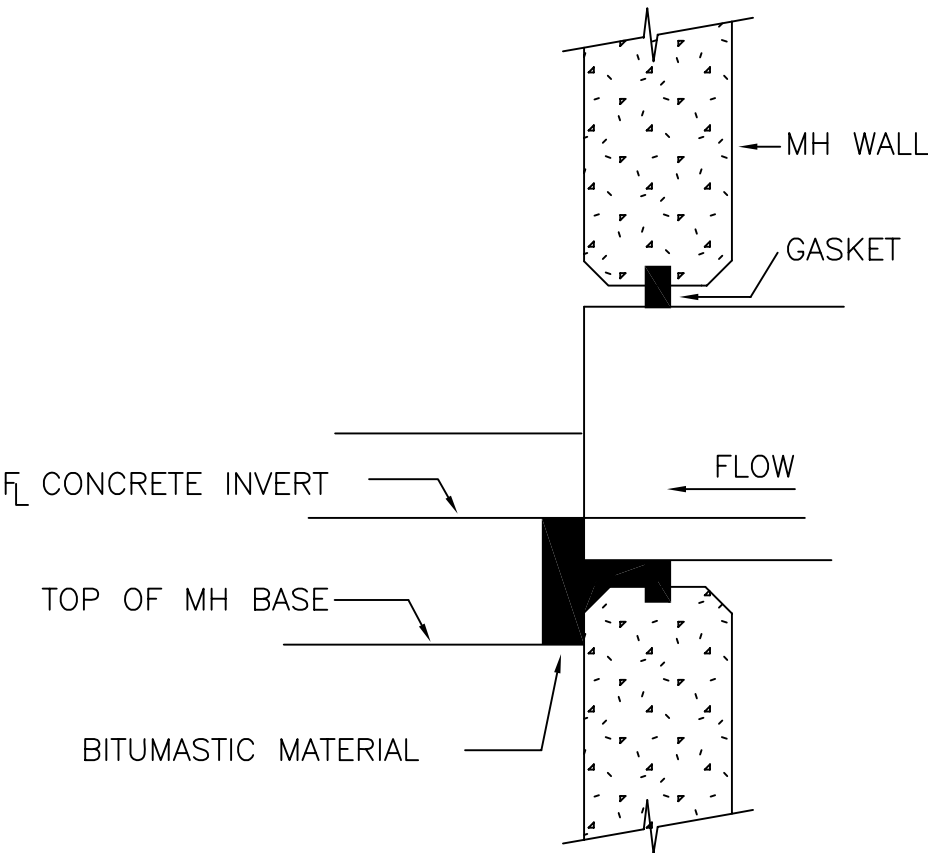
	REVISIONS	7/07 - MSG EDITS	AMERICAN WATER STANDARD CIVIL STANDARD PRECAST MANHOLE (ECCENTRIC CONE)	
			AMERICAN WATER VOORHEES, NJ 08043	
			AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
				
			DRAWN BY RJB PROJECT ENG'R APPROVED	
			DATE 07-31-06 PROJECT IP	
			USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	
			0202-0601-SD3	




## MANHOLE COVER DETAIL

DEETER 1315 OR APPROVED EQUAL  
"SANITARY SEWER"  
CAST IN LID

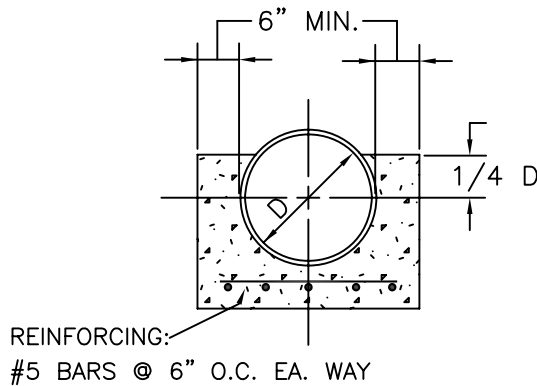
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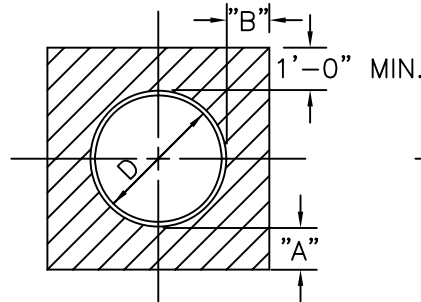
FLEXIBLE WALL CONNECTION

REVISIONS		AMERICAN WATER STANDARD CIVIL FLEXIBLE WALL CONNETION DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
		 American Water	
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 07–31–06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
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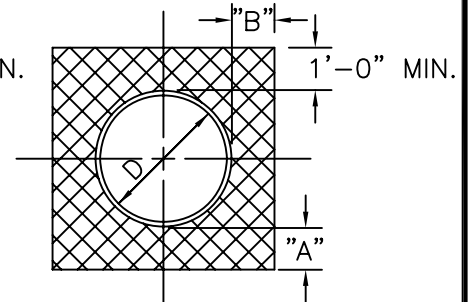
TYPE	P	LOAD FACTOR
REINFORCED	0.40%	3.5
REINFORCED	1.00%	4.8
PLAIN		2.8



STANDARD CONCRETE  
EMBEDMENT



CLASS "B" BEDDING  
(FLEXIBLE OR SEMI-  
FLEXIBLE PIPE)




CLASS "B" BEDDING  
(RIGID PIPE)

## STANDARD EMBEDMENTS

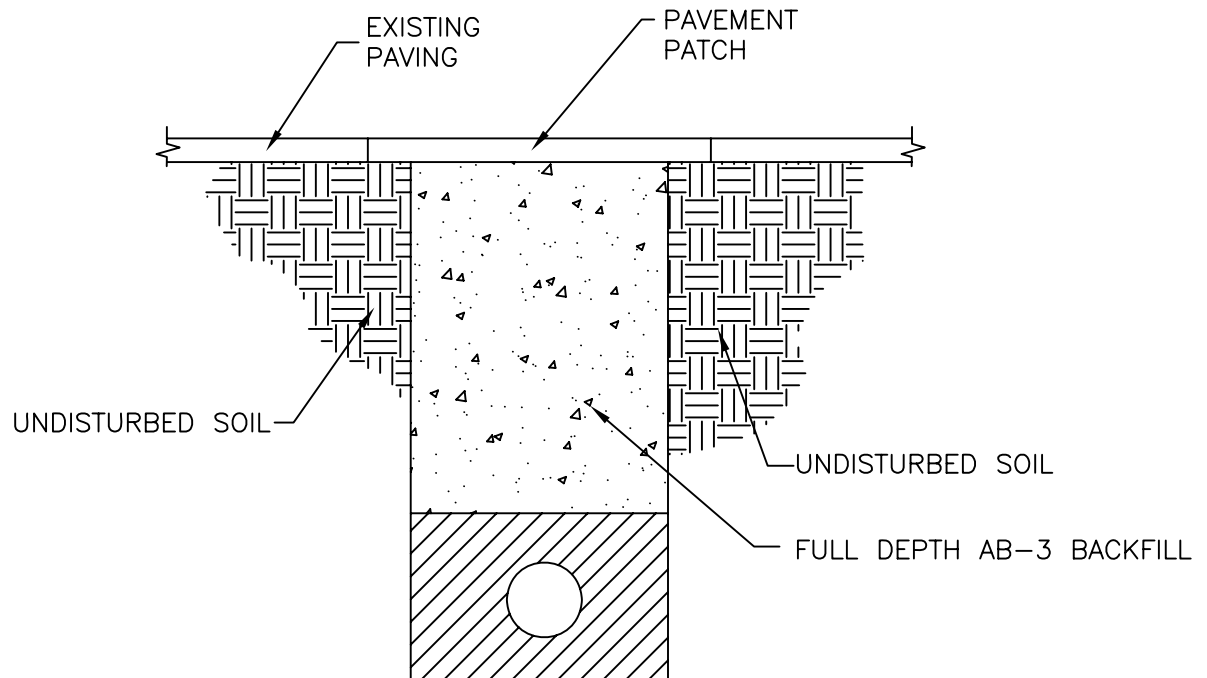
TABLE OF BEDDING DEPTHS & SIDE CLEARANCES				
D	ROCK		SOIL	
	A	B	A	B
4"-18"	6"	6"	4"	6"
21"-24"	9"	9"	4"	7"
27"-30"	9"	9"	4"	8"

	HAND PLACED & HAND TAMPED BACKFILL
	GRANDULAR FILL - KDOT CA-5
	CONCRETE

- D NOMINAL PIPE SIZE  
A FILL BELOW PIPE (SEE TABLE)  
B SIDE CLEARANCES (SEE TABLE)  
P AREA TRANSVERSE STEEL  
EXPRESSED AS A % OF AREA  
OF CONCRETE AT CROWN


REVISIONS		AMERICAN WATER STANDARD CIVIL STANDARD EMBEDMENTS DETAIL	
7/07 – MSG EDITS			
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## EXISTING ROAD CROSSING BACKFILL DETAIL

N.T.S.

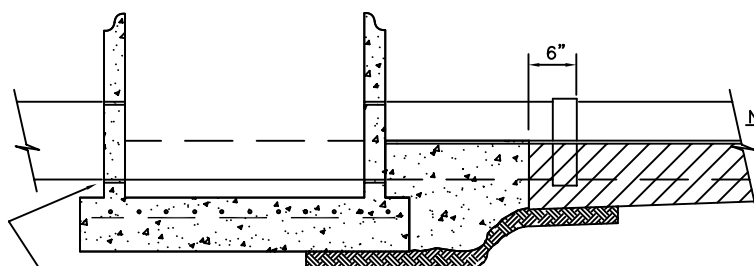
REVISIONS		AMERICAN WATER STANDARD CIVIL EXISTING ROAD CROSSING BACKFILL DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
		 American Water®	
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Information Only Subject to Revision

FINAL

Tuesday, January 17, 2012

0202-0601-SD7



THE MINIMUM DISTANCE BETWEEN THE INVERT OF THE DOWNSTREAM PIPE AND THE TOP OF THE MANHOLE BASE SHALL BE THREE (3) INCHES.

NOTES: 1ST JOINT OF PIPE SHALL BE EMBEDDED IN CONCRETE TO WITHIN 6" OF THE 1ST JOINT FOR RCP & VCP.

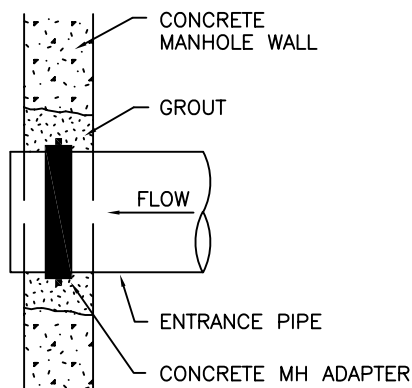
IF A FLEXIBLE WALL CONNECTION IS USED, CLASS B EMBEDMENT MAY BE USED.

IF FLEXIBLE OR SEMI-FLEXIBLE PIPE IS USED, A FLEXIBLE WALL CONNECTOR MUST BE USED.

FLEXIBLE WALL CONNECTIONS SHALL BE PRESS WEDGE, A-LOCK, PRESS-SEAL (PSX GASKET) OR APPROVED EQUAL.

### MANHOLE BASE SECTION

N.T.S.



### CONCRETE MANHOLE ADAPTER

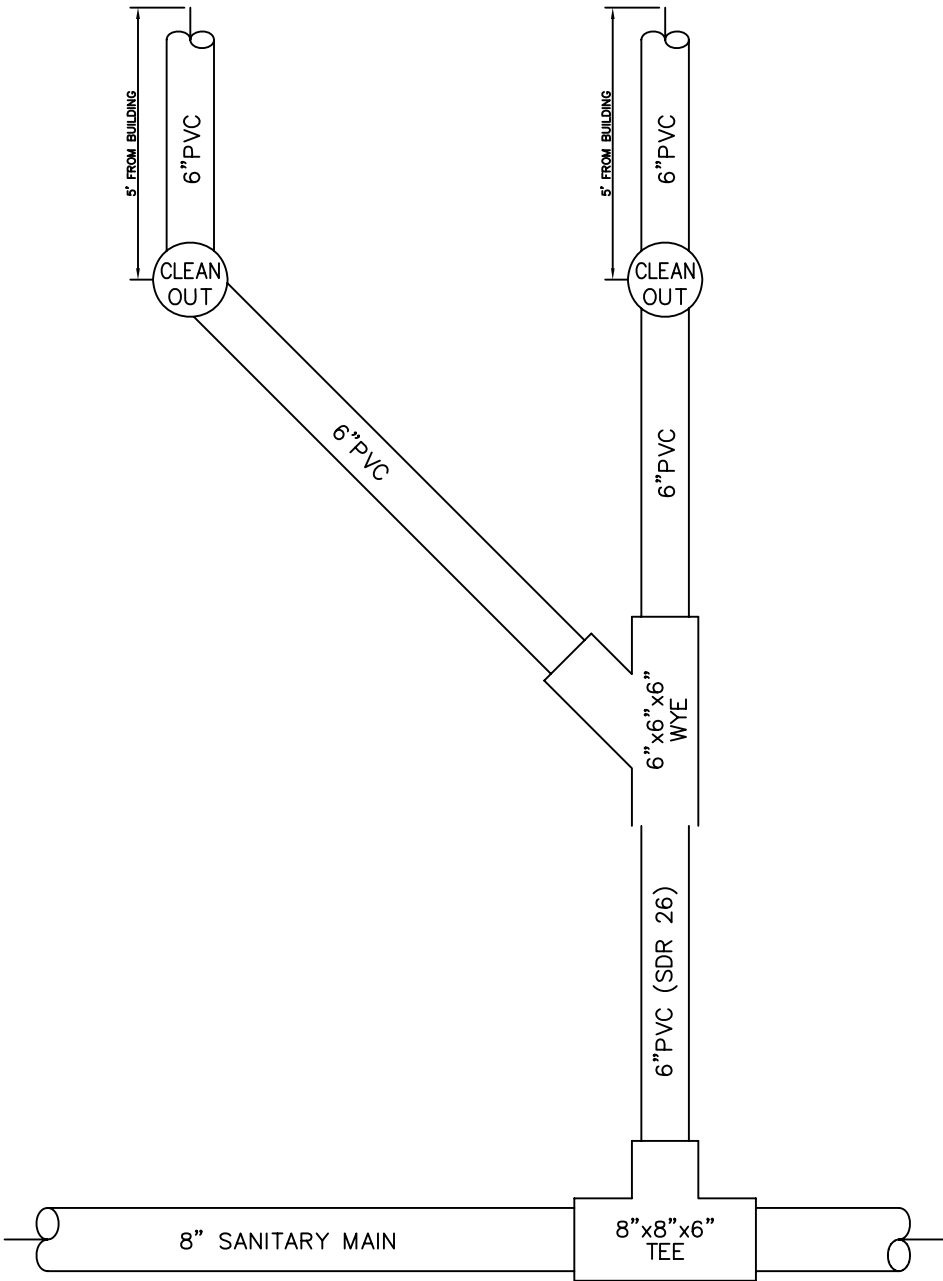
N.T.S.

(USE FOR PIPES ENTERING EXISTING MANHOLE WALLS)


REVISIONS		AMERICAN WATER STANDARD CIVIL MANHOLE BASE SECTION & CONCRETE ADAPTER DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
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0202-0601-SD8



CLEANOUT PLAN DETAIL  
N.T.S.

	REVISIONS		AMERICAN WATER STANDARD CIVIL CLEANOUT PLAN DETAIL	
	7/07 – MSG EDITS			
			AMERICAN WATER VOORHEES, NJ 08043	
			<div>AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075</div> <div>American Water</div>	
			<div>DRAWN BY RJB PROJECT ENG'R APPROVED</div> <div>DATE 07-31-06 PROJECT IP</div> <div>USE DIMENSIONS ONLY SCALE N.T.S.</div>	
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0202-0601-SD9	

## Appendix JJ

### AMERICAN WATER STANDARD WATER AND WASTEWATER CONSTRUCTION SPECIFICATIONS

AW – US MILITARY  
STANDARD SPECIFICATION

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AW – US MILITARY  
STANDARD SPECIFICATION

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## SECTION 01300

### SUBMITTALS

#### PART 1 GENERAL

##### .01 CONSTRUCTION SCHEDULE

- A. Prepare and submit detailed progress schedules, schedule of values and shop drawing and sample submittal schedules to American Water. The schedule shall be in bar graph form and shall include, as a minimum, the following separate activities:
1. Physical construction (identifying mobilization, demobilization, setup time, lags, etc.).
  2. Issuance by Contractor of purchase orders for material and equipment and submittal of shop drawings and samples to the Engineer.
  3. Review by Engineer for each submittal of samples and shop drawings. Unless otherwise approved by the Engineer, allow ten (10) working days for Engineer to review each submittal.
  4. Fabrication time for materials and equipment.
  5. Delivery of materials and equipment.
  6. Installation of materials and equipment.
  7. Testing, start-up and training for individual pieces of equipment or entire systems as appropriate.
  8. Weather affected activities.
  9. Outages or interruptions of Owner's facilities required to perform work.
  10. Demolition or removal work under this Contract.
- B. Activity durations shall represent the best estimate of elapsed time considering the scope of the Work involved in the activity and the resources planned for accomplishing the activity expressed in working days.
- C. Activity descriptions shall clearly define the scope of work associated with each activity.
- D. Detail the construction work schedule to an extent that progress can be readily monitored on a weekly basis. In general, the construction work shall be detailed such that no construction activity shall have duration

greater than fifteen (15) work days. As a minimum, each activity shall be coded by:

1. Activity type (i.e., submittal, Engineer's review, material order material delivery, pilot hole drilling, well testing, development, etc.).
  2. Responsibility (i.e., Contractor, subcontractor A, subcontractor B, Owner, Engineer, etc.).
  3. Area (i.e., Pilot Wells, Production Wells, sitework, etc.).
- E. Develop the construction schedule as necessary to properly control and manage the project. The above schedule development requirements are a minimum.
- F. The preliminary progress schedule shall be submitted in a bar graph format and shall include, as a minimum, a graphic representation of all significant activities and events involved in the construction of the project. The graphic representation and statement must clearly depict and describe the sequence of activities planned by the Contractor, their interdependence and the times estimated to perform each activity.

## .02 FINALIZING SCHEDULES

- A. Prepare to present and discuss at the preconstruction meeting, the schedules submitted in accordance with this specification. Unless additional information is required to be submitted by the Contractor, the Engineer will, within 15 working days of the preconstruction conference, provide comments to the Contractor. Then resubmit the affected schedules addressing the Engineer's comments.
- B. Approval of the final schedules by the Engineer is advisory only and shall not relieve the Contractor of responsibility for accomplishing the work within the Contract Times. Omissions and errors in the approved schedule shall not excuse performance less than that required by the Contract. Approval by the Engineer in no way makes the Engineer an insurer of the success of those schedules or liable for time or cost overruns flowing from shortcomings in such schedules.

## .03 REQUIREMENTS FOR CONFORMING TO SCHEDULE

- A. Take such steps as will be necessary to improve progress, if, in the opinion of the Engineer, the Contractor falls behind the progress schedule. Engineer may require Contractor to increase the number of shifts and/or overtime operations, days of work, and/or the amount of construction planned, and to submit for approval such supplementary schedule or

01300-2



schedules as may be deemed necessary to demonstrate the manner in which the agreed rate of progress will be regained, all without additional cost to the Owner. An updated cash flow schedule will be required in this occurrence and will be provided with the supplementary schedules referenced above.

#### .04 UPDATING SCHEDULES

- A. Submit to the Engineer monthly updates of the schedules required per this specification section. Be prepared to discuss the monthly update and the subsequent monthly job meeting if such meetings are to be held.
- B. Progress and shop drawing schedule updates shall reflect the progress to date by providing actual start dates for activities started, actual finish dates for completed activities, and identifying out of sequence work, schedule logic changes and any circumstances or events impacting the current schedule. The updates shall also contain the Contractor's best estimate of the remaining duration for activities not complete as of the date of the update. All graphic presentations and other information required per the initial submittal of these schedules shall be provided with each update.
- C. The cash flow schedules shall be updated to reflect any changes.

#### .05 ADJUSTMENT OF PROGRESS SCHEDULE AND CONTRACT TIMES

- A. If the Contractor desires to make changes in the method of operating which affect the approved progress schedule, notify the Engineer in writing stating what changes are proposed and the reason for the change. If the Engineer approves these changes, revise and submit for approval, without additional cost to the Owner, all of the affected portions of the schedule.
- B. Shop drawings and samples which are not approved on the first submittal or within the schedule time shall be immediately rescheduled, as well as any work which fails to pass specified tests or has been rejected.
- C. The Contract Times will be adjusted only for causes specified in the General Conditions. In the event the Contractor requests an adjustment of the Contract times, furnish such justification and supporting evidence as the Engineer may deem necessary for a determination as to whether the Contractor is entitled to an adjustment of Contract Times under the provisions of the General Conditions. The Engineer will, after receipt of such justification and supporting evidence, make findings of fact and will advise the Contractor in writing. If the Engineer finds that the Contractor is entitled to any adjustment of the Contract Times, the Engineer's

01300-3

determination as to the total number of days adjustment shall be based upon the currently approved progress schedule and on all data relevant to the adjustment. The Contractor acknowledges and agrees that actual delays in activities which, according to the progress schedule, do not affect the Contract completion date shown by the critical path in the schedule will not be the basis for an adjustment of Contract Times.

- D. From time to time it may be necessary for the progress schedule and/or Contract Times to be adjusted by the Owner to reflect the effects of job conditions, weather, technical difficulties, strikes, unavoidable delays on the part of the Owner, and other unforeseeable conditions which may indicate schedule and/or Contract Times adjustments. Under such conditions, the Engineer shall direct the Contractor to reschedule the work and/or Contract Time to reflect the changed conditions. Revise the construction schedule accordingly. No additional compensation shall be made to the Contractor for such changes except as provided in the General Conditions. Unless otherwise directed, take all possible actions to minimize any extension to the Contract Times and any additional cost to the Owner.

#### .06 SHOP DRAWINGS

- A. Promptly supply to the Engineer for approval, shop drawings with details and schedules for all items as noted in the Drawings and/or Specifications and/or required by the Engineer. Submittals are required for all equipment and materials to be installed on the job.
- B. One (1) copy of all drawings, schedules and brochures shall be submitted for approval. Each submittal shall have the job name on it. Shop drawings may be submitted to AWMSG electronically.
- C. Submittals smaller than 8-1/2 by 11 inches shall be secured to paper 8-1/2 by 11 inches.

#### .07 SAMPLES

- A. When required by the Engineer or where noted in other Sections of these Specifications, samples of materials shall be submitted for approval.

#### .08 PRE-CONSTRUCTION VIDEO/ELECTRONIC PHOTOS

- A. If required by AWMSG, and prior to mobilization at the site, furnish to the Engineer on DVD a video recording of all planned construction areas, material storage areas, areas adjacent to these areas, including but not

01300-4

limited to, streets, driveways, sidewalks, curbs, ditches, fencing, railing, visible utilities, retaining structures and adjacent building structures. The purpose of the video is to document existing conditions and to provide a fair measure of required restoration. Care should be taken to record all existing conditions which exhibit deterioration, imperfections, structural failures or situations that would be considered substandard. Notify the Engineer when the video is to be taken to provide the Engineer an option to be on site during the documenting of the project area.

- B. The video shall be high quality, color and in an approved electronic format. Temporary lighting shall be provided as necessary to properly video areas where natural lighting is insufficient (indoors, shadows, etc.). The video shall include an audio soundtrack to provide the following information:
1. Detailed description of location being viewed referenced to Contract Drawings (i.e., well location, building designation, pipeline route etc.)
  2. Direction (N, S, E, W, looking up, looking down, etc.) of camera view
  3. Date, time, temperature, environmental conditions during recording.

Where required by Engineer, electronic photographs of specific locations shall be provided to supplement the electronic video.

- C. Any areas not readily visible by video/photo methods shall be described in detail. Unless otherwise approved by Engineer, video shall not be performed during inclement weather or when the ground is covered partially or totally with snow, ice, leaves, etc.
- D. As many recordings or photos as are necessary to satisfy the requirements of this section shall be prepared. The original documents shall be submitted to the Engineer accompanied by a detailed log of the contents of each DVD. The log should include location descriptions with corresponding file name to facilitate the quick location of information contained on the DVDs. The DVDs will be maintained by the Engineer during construction and may be viewed at any time by Contractor upon request. Upon final acceptance, the DVDs will become the permanent property of the Owner.

## .09 PROGRESS PAYMENTS

- A. The detailed arrangement for submittal of progress payments shall be discussed at the preconstruction meeting. In general, progress payments shall be submitted monthly in AIA format to the Engineer. The progress

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payment request shall be based on the unit prices and should provide the percentage of completion, total dollar value completed, dollar value completed prior to the current payment, and the amount requested for this progress payment for each line item contained in the schedule of values. Progress payment requests for material and/or equipment suitably stored but not yet incorporated into the work shall be accompanied by a copy of the appropriate manufacturers invoice, shipping order, bill of lading, etc. and the progress payment amount shall be the direct cost to the Contractor, or subcontractor, for such material and/or equipment. Payment will not be made to the Contractor if, upon inspection by the Engineer, it is determined that the material and/or equipment does not conform to the requirements of the Contract Documents including proper storage, receipt of approved shop drawings, receipt of any special guarantees, Bonds, insurance coverage, any evidence of damage or imperfections, etc.

#### .10 CONTRACTOR'S DAILY REPORTS

- A. If requested by the Engineer or the Resident Project Representative, prepare and submit daily reports containing the following information:
  - 1. The number of craftsmen and hours worked of each subcontractor,
  - 2. The number of hours worked by each trade,
  - 3. The number of hours worked of each type of equipment,
  - 4. A description of work activities performed,
  - 5. A description of any material or equipment deliveries,
  - 6. Description of obstructions encountered,
  - 7. The temperature and weather conditions.
  - 8. Downtime due to equipment failure.
  - 9. Detail cause for work delays.
- B. The daily reports shall be submitted on a daily basis, by the end of the next business day.
- C. Information provided on the daily report shall not constitute notice of delay or any other notice required by the Contract Documents. Notice shall be as required therein.

#### .11 OPERATING AND MAINTENANCE INSTRUCTION MANUALS

- A. Prepare complete written maintenance and operating instructions covering any equipment provided under this Contract. Divide the operating instructions into basic sections according to type of equipment.

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- B. Instructions shall describe all equipment and controls, their purpose, and their operation and use. Include maintenance checklists for use by the Owner's personnel and a complete listing of replacement parts with pertinent information relative to ordering such parts.
- C. Submit instructions in duplicate draft form for review by the Engineer at least eight weeks prior to initial operation and in final form within thirty days after return of one copy of the draft with the Engineer's notations.
- D. Prior to release of Final Payments, revise and resubmit copies of the instructions to accord with any changes in procedures or equipment made during start-up or initial operation. Resubmittals are also required for changes made during the guarantee period.

## .12 REQUIREMENTS FOR AMERICAN WATER ASSET VALUES

Provide a breakdown of the contract amount by Property Units in accordance with the list of Property Units that can be provided as requested. This process requires that the contractor assign the full cost of the project to lengths of pipe (by material and size), length of services (by material and size), hydrants, valves (by size), manholes and other fixtures (air relief valves, blowoffs, etc.) in the project. The submission must be approved by the Engineer to verify that the breakdown is realistic and reflects submitted contract unit prices.

## **PART 2 PRODUCTS**

### **1.01 TESTING DATA CERTIFICATES**

Product testing shall comply with all respective AWWA standards. The certificates of compliance shall be electronically scanned and submitted by E-mail to the Engineer or by submitting the hard copy originals to the Engineer.

## **PART 3 EXECUTION**

Not Used.

**END OF SECTION 01300**

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## **SECTION 02025**

### **EXISTING UTILITIES AND STRUCTURES**

#### **PART 1 GENERAL**

##### **01 SCOPE OF WORK**

Certain information regarding the reputed presence, size, character, and location of existing Underground Facilities such as pipes, drains, sewers, electrical lines, telephone lines, cable TV lines, gas lines, and water lines has been shown on the Contract Drawings and/or provided in the contract documents. This information with respect to Underground Facilities is provided by the Owner in accordance with conditions described in the General Conditions and for informational purposes only. The Contractor is responsible to determine actual location of all utilities in proximity to the work for the purposes of the preparation of their bid and during construction.

##### **1.02 NOTIFICATION OF UTILITIES**

Notify the applicable State Agency with jurisdiction over underground facilities and/or all utility companies that construction work under this Contract will pass through containing their underground facilities. Notify these parties in advance to support the construction work (**minimum 72 hours**). All excavation in the vicinity of existing underground utilities shall be performed in accordance with applicable regulations.

#### **PART 2 PRODUCTS**

##### **.01 MATERIALS**

Furnish all materials for temporary support, adequate protection, and maintenance of all underground and surface utility structures, supports, drains, sewer, and other obstructions encountered in the progress of the work.

## **PART 3 EXECUTION**

### **.01 OBSTRUCTIONS BY OTHER UTILITY STRUCTURES**

Support, relocate, remove, or reconstruct existing utility structures such as conduits, ducts, pipes, branch connections to main sewers, or drains. The obstruction shall be permanently supported, relocated, removed or reconstructed where they obstruct the grade or alignment of the pipe. Contractor must do so in cooperation with the owners of such utility structures. Before proceeding, the Contractor must reach an agreement with the Engineer on the method to work around the obstruction.

No deviation shall be made from the required line or depth without the consent of the Engineer.

### **.02 REPAIRS**

- A. Repair or replace any damage to existing structures, work, materials, or equipment incurred by Contractor's operations.
- B. Repair all damage to streets, roads, curbs sidewalks, highways, shoulders, ditches, embankments, culverts, bridges, trees, shrubs or other public or private property caused by transporting equipment, materials or personnel to or from the work site. Make satisfactory and acceptable arrangements with the persons or agencies having jurisdiction over the damaged property concerning repair or replacement
- C. Brace and support existing pipes or conduits crossing the trench, or otherwise exposed to prevent trench settlement from disrupting the line or grade of the pipe or conduit. Before proceeding, the Contractor must reach an agreement with the Engineer on the method of bracing and support. Repair or replace all utility services broken or damaged at once to avoid inconvenience to customers. Storm sewers shall not be interrupted overnight. Use temporary arrangements, as approved by the Engineer, until any damaged items can be permanently repaired. Maintain all items damaged or destroyed by construction and subsequently repaired.
- D. Standard Detail 0201-0601-SD44 (attached) provides requirements for repair or replacement of sanitary or storm drains removed or damaged during installation of the water main.



### .03 RELOCATION

Relocate existing utilities or structures, where necessary, and restore it to a condition equal to that of the original facility. Obtain approval of the owner of the utility or structure prior to relocating and/or restoring the facility.

### .04 SEPARATION OF WATER MAINS AND SANITARY SEWERS

#### A. General

Consider the following factors when determining adequate separation:

- (1) Materials and type of joints and restraints for water and sanitary sewer pipes,
- (2) Soil conditions & backfill materials,
- (3) Service and branch connections into the water main and sanitary sewer line,
- (4) Compensating variations in horizontal and vertical separations,
- (5) Space for repair and alterations of water and sanitary sewer pipes,
- (6) Off-setting of pipes around manholes.

#### B. Parallel Installation

Lay water mains at least 10 feet horizontally from any existing or proposed sanitary sewer. Measure the distance from edge to edge. In cases where it is not practical to maintain a 10-foot separation, the applicable State Agency may allow deviation on a case-by-case basis, if supported by data from the Engineer. Such deviation may allow installation of the water main closer to a sanitary sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sanitary sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sanitary sewer.

### C. Crossings

Whenever water mains must cross sanitary sewer laterals or sanitary sewers, lay the water main at such an elevation that the bottom of the water main is 18 inches above the top of the sanitary sewer pipe. Maintain this vertical separation for the portion of the water main located within 10 feet horizontally of any sanitary sewer it crosses. The 10 feet is measured as a perpendicular distance from sanitary sewer line to the water line.

### D. Exception

Notify the Engineer when it is impossible to obtain the proper horizontal and vertical separation as stipulated above. If directed by the Engineer, both the water main and sanitary sewer line shall be constructed of, mechanical joint ductile iron or welded joint protected steel pipe. Other types of restrained joints of equal or greater integrity may be used at the discretion of the Engineer after consultation with the applicable State Agency. Thermoplastic sanitary sewer pipe may be used provided mechanical or solvent weld pipe joints are used and accepted by the Engineer. Pressure test these joints before backfilling to assure that they are water tight. Where water mains must cross under a sanitary sewer, additional protection shall be provided by:

- (1) A vertical separation of at least 18 inches between the bottom of the sanitary sewer and the top of the water line,
- (2) Adequate structural support for the sanitary sewer to prevent excessive deflection of the joints and the settling on and breaking of the water line,
- (3) Centering the section of water pipe at the point of the crossing so that the joints shall be equidistant and as far as possible from the sanitary sewer line.

Consult the applicable State Agency, through the Engineer, to discuss the use of double casing or concrete encasement of sanitary sewer and/or water lines as possible alternatives when the above conditions cannot be met.

## .05 SEPARATION OF WATER MAINS AND STORM SEWERS

Where water mains and storm sewers would run parallel, lay water mains at least 10 feet horizontally from the existing or proposed storm sewer (measured from edge to edge). Where storm sewers and water mains would cross, place water mains at least 12 inches from the storm sewer (measured from edge to edge). In cases where it is not practical to maintain the specified separation, the Engineer may allow deviation on a case by case basis or as clearly called out in the plans. If the Engineer deems that such deviation will be allowed, install the water main as directed by the Engineer in such a way that does not compromise more stringent and desired separation from sanitary sewers per subsection 3.04.

**END OF SECTION 02025**

## **SECTION 02105**

### **CLEARING AND GRUBBING**

#### **PART 1: GENERAL**

##### **1.01 PROTECTION**

Protect existing trees, shrubs and bushes located outside the clearing limits from damage for the life of this Contract.

##### **1.02 REQUIREMENTS OF REGULATORY AGENCIES**

Comply with State and local code requirements when disposing of trees, shrubs and all other materials removed under this Specification Section. Coordinate all clearing work with utility companies as necessary.

##### **1.03 DISPOSAL FEES**

Bear all expenses to obtain a suitable disposal area, haul to the disposal area, pay disposal fees, and dump at the disposal area.

#### **PART 2: PRODUCTS**

##### **2.01 MATERIALS AND EQUIPMENT**

Provide all materials and equipment required to complete all clearing and grubbing in accordance with this Specification Section.

#### **PART 3: EXECUTION**

##### **3.01 CLEARING AND GRUBBING**

Clear and grub the minimum area required to provide space for construction operations.

- A. Clear and grub the work site within easement and/or clearing limit lines shown on the Drawings or as shown elsewhere in the Contract Documents. Remove those items that are designated for removal or obstruct construction. This includes, but is not limited to; trees, downed timber, shrubs, bushes, vines, roots, stumps, undergrowth, rubbish, paving materials, debris, and all other objectionable materials. Site objects outside clearing limits shall not be removed. Only those portions of the construction area which are absolutely necessary and

essential for construction shall be cleared. Minimize the length of time of ground disturbance as much as practical, especially within environmentally sensitive areas. Ground shall not be cleared and grubbed until immediately prior to construction.

- B. Notify the Engineer of locations where additional trees and shrubs will interfere with installation of facilities. Do not remove additional trees or shrubs without written permission of Engineer. Conduct operations to minimize disturbance of trees and shrubs. Trim trees and roots in accordance with the best horticultural practices, including sealing cuts to preserve the tree.

### 3.02 CLEARING (IMPROVED AREA)

- A. Remove site improvement objects such as signs, lawn ornaments, etc. which interfere with construction. Removed site improvement objects shall be stored in a manner protecting objects for reinstallation after construction is complete. Relocate the mailbox as necessary. Provide temporary traffic control signs when permanent signs are removed for construction. Temporary signs shall be worded to match permanent signs, except as necessary to be compatible with construction operations.
- B. Remove pavement, curb and sidewalk in accordance with applicable State Standards for Road and Bridge Construction and as specified in these Contract Documents. Saw cuts may be eliminated where paving abuts curb or roadway expansion joints or construction joints, and pavement can be removed without damaging or disturbing curbs or remaining pavement,. Remove sidewalks in full squares only. Saw cut sidewalks if no true joint exists.

### 3.03 DISPOSAL

- A. Burning of logs, stumps, roots, and other material on the site will not be permitted.
- B. All materials obtained as a result of the clearing and grubbing operations shall be disposed of in accordance with the requirements of the applicable governing agencies.
- C. Chipping of brush materials is permitted, however, Contractor shall bear all costs to dispose of the resultant chips at an approved location.

**END OF SECTION 02105**

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## SECTION 02220

### CASING INSTALLATION

#### PART 1: GENERAL

##### 1.01 GENERAL REQUIREMENTS

The installation of casing pipe shall conform to these Specifications and any Federal, State or local Highway requirements or applicable Railroad requirements whichever may be more restrictive.

##### 1.02 SUBMITTALS

Submit details of proposed jacking or boring pits to the Engineer showing locations, dimensions, and details of sheeting and shoring required, if requested.

##### 1.03 RELATED WORK

Excavation, backfilling and compaction for jacking and receiving pits and for open cut installation shall conform to the requirements set forth in Specification Sections 02317 and 02320.

#### PART 2: PRODUCTS

##### 2.01 MATERIAL

Casing pipe shall be bare wall steel pipe with a minimum yield strength of 35,000 psi and a minimum wall thickness as listed below:

Casing Outside Diameter <u>Inches</u>	Highway Crossings Casing Wall Thickness <u>Inches</u>	Railroad Crossings Casing Wall Thickness <u>Inches</u>
8.625	0.250	0.250
10.75	0.250	0.250
12.75	0.250	0.250
14	0.250	0.281
16	0.250	0.281
18	0.250	0.312
20	0.312	0.344
24	0.312	0.406
30	0.375	0.469
36	0.500	0.532

42	0.500	0.563
48	0.625	0.625
54	0.625	0.688
60	0.625	0.750
66	0.625	0.813
72	0.750	0.875

Smooth wall steel plates with a nominal diameter of over 54 inches shall not be permitted.

The inside diameter of the casing pipe shall be: at least four (4) inches greater than the outside diameter of the carrier pipe joints or couplings for carrier pipe less than six (6) inches in diameter; and at least six (6) inches greater than the outside diameter of the carrier pipe joints or couplings for carrier pipe six (6) inches and greater in diameter.

## **PART 3 EXECUTION**

### **3.01 ALIGNMENT AND GRADE**

Locate pipelines to cross roadways or tracks at approximately right angles where practicable, but preferably at not less than 45 degrees. Do not place pipelines in culverts or under bridges where there is a likelihood of their restricting the area required for the purposes for which the bridges or culverts were built, or of endangering the foundations. Install the casing pipe on an even grade for its entire length and sloped to one end or as noted in a profile plan if provided. Satisfy a maximum tolerance of 1.5% (18" in one hundred feet) with the desired location of the casing or as otherwise required by regulation or specified on the plans, whichever is more restrictive.

### **3.02 WELDING**

Connect steel casing sections by welding. Welding shall conform to AWWA Standard C206.

### **3.03 PROTECTION AT ENDS OF CASING**

Block up both ends of casings in such a way as to prevent the entrance of foreign material, but to allow leakage to pass in the event of a carrier break.

### 3.04 DEPTH OF INSTALLATION

Unless the depth of casing pipe is specifically specified on the drawings, the casing pipe depth shall be in accordance with highway or railroad requirements.

### 3.05 CASING INSULATORS

The carrier pipe and casing shall be separated by an insulator. The insulator spacing shall be installed to support the weight of the pipe and contents. As a minimum, an insulator shall be placed a maximum of 3 foot from each side of a joint and evenly spaced along the carrier pipe with 3 insulators per each length of carrier pipe. Timber skids are not allowed. Casing insulators shall be sized according to the manufactures specifications for pipe sizes.

At the sole discretion of the Engineer, alternate manufactures in lieu of those described above and new or improved products by the same manufactures may be permitted. To seek approval, adequately describe any proposed alternate product and submit the same with shop drawings and specifications to the Engineer. The Contractor cannot proceed to employ said alternate products prior to receiving written approval of from the Engineer.

### 3.06 INSTALLATION

Install casing pipes by one of the following methods:

#### A. Jacking

This method shall be in accordance with the current American Railway Engineering Association Specifications, Chapter 1, Part 4, "Jacking Culvert Pipe Through Fills", except that steel pipe shall be used with welded joints. Conduct this operation without hand mining ahead of the pipe and without the use of any type of boring, auguring or drilling equipment.

Design the bracing, backstops, and jacks so that the jacking can progress without stoppage (except for adding lengths of pipe).



### B. Drilling

This method employs the use of an oil field type rock roller bit, or a plate bit made up of individual roller cutter units, welded to the pipe casing being installed. Turn the pipe for its entire length from the drilling machine to the head to give the bit the necessary cutting action against the ground being drilled. Inject high density slurry (oil field drilling mud) through a supply line to the head to act as a cutter lubricant. Inject this slurry at the rear of the cutter units to prevent any jetting action ahead of the pipe. Advance the drilling machine on a set of steel rails (thus advancing the pipe) by a set of hydraulic jacks. The method can be used to drill earth or rock.

### C. Boring

This method consists of pushing the pipe into the fill with a boring auger rotating within the pipe to remove the soil. When augers or similar devices are used for pipe placement, the front of the pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger and cutting head from leading the pipe so that there will be no unsupported excavation ahead of the pipe. The auger and cutting head arrangement shall be removable from within the pipe in the event an obstruction is encountered. The over-cut by the cutting head shall not exceed the outside diameter of the pipe by more than one-half inch. The face of the cutting head shall be arranged to provide reasonable obstruction to the free flow of soft or poor material.

If an obstruction is encountered during installation that stops the forward action of the pipe, and if it becomes evident that it is impossible to advance the pipe, operations will cease and the pipe shall be abandoned in place and filled completely with grout.

Bored or jacked installations shall have a bore hole essentially the same as the outside diameter of the pipe. Grout any voids that develop. Also grout around the casing pipe when the bore hole diameter is greater than the outside diameter of the pipe by more than 1 inch.

### D. Directional Drilling

See Specification Section 02458

**END OF SECTION 02220**

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## **SECTION 02230**

### **STREAM CROSSING**

#### **PART 1: GENERAL**

##### **1.01 SCOPE**

Furnish all labor, materials, and equipment necessary to install the stream crossings as shown on the plans and described in the construction documents.

Install the stream crossings in such a manner as to protect the mains from erosion and to restore, as much as practicable, the stream banks and bottom to their original condition and in compliance with requirements of the regulating agency.

Protect the main from erosion by concrete encasement around the pipe or by a sufficient depth of compacted backfill as shown.

##### **1.02 PROFILES AND TOPOGRAPHY**

Contours, topography and profiles of the ground shown on the Drawings are believed to be reasonable approximations and are not guaranteed.

The Contractor accepts the construction site with the conditions that existed at the time of bidding.

##### **1.03 RELATED WORK**

Excavation, backfilling and compaction procedures shall conform to Specification Sections 02317 and 02320.

Concrete placement shall conform to Specification Section 03300.

#### **PART 2: PRODUCTS**

##### **2.01 MATERIALS**

Excavation, fill and concrete materials shall be as specified in

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Specification Sections 02317, 02320 and 03300.

## **PART 3: EXECUTION**

### **3.01 CONSTRUCTION PROCEDURE**

Comply with construction procedures if provided as a condition of the permitting process, provide and submit the same to the Engineer and all Federal, State, and local authorities having jurisdiction over the stream crossing for their review and approval.

### **3.02 STREAM BANK RESTORATION**

Restore the stream banks by backfilling the main trench with mechanically compacted backfill of earth or rip rap, approved by the Engineer and in compliance with regulatory requirements, to the original ground surface (unless new contours are shown on drawings). The limits of compaction shall extend from the top of bank to top of bank on each side of the crossing as determined by the Engineer.

Immediately following the completion of a stream crossing, place straw bales or silt-fence along the trench excavation on each stream bank from within two (2) feet of the edge of water to beyond the limits of the excavated trench width per detail on straw bale and fabric fence. Straw bales or silt-fence shall remain in place until after the stream banks have been fine graded, fertilized and seeded, and the seeding has grown sufficiently to protect the stream banks from erosion.

### **3.03 STREAM BOTTOM RESTORATION**

If the plans call for open cut across the stream bottom, backfill the trench within the stream bottom (high water to high water) mechanically compacted earth or riprap that has been approved by the Engineer and meeting regulatory requirements. Rip rap placement must be flush with stream bottoms from upstream to downstream.

**END OF SECTION 02230**

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**SECTION 02235****BRIDGE CROSSING****PART 1 GENERAL****.01 SCOPE OF WORK**

Certain information regarding the reputed presence, size, character, and location of existing above ground and underground Facilities such as pipes, drains, sewers, electrical lines, telephone lines, cable TV lines, gas lines, and water lines has been shown on the Contract Drawings and/or provided in the contract documents. This information with respect to Underground Facilities is provided by the Owner in accordance with conditions described in the General Conditions and for information purposes only. Contractor is responsible to determine actual location of all utilities in proximity to the work for the purposes of the preparation of their bid and during construction.

**.02 NOTIFICATION OF UTILITIES**

Notify the applicable State Agency with jurisdiction over the bridge facilities and all utility companies that construction work under this Contract will pass nearby containing their facilities. Notify these parties in advance to support the construction work (**minimum 72 hours**). All excavation in the vicinity of existing underground utilities shall be performed in accordance with applicable regulations.

**.03 BRIDGE CROSSINGS**

Notify the applicable State Agency and Transportation Organization with jurisdiction over bridge facilities and/or all utility companies that construction work under this Contract will pass at or near the bridge structure. Notify these parties in advance to support the construction work (minimum 72 hours or as required by the organization with jurisdiction). All construction in the vicinity of existing bridge structures shall be performed in accordance with applicable regulations.

**PART 2 PRODUCTS****.01 MATERIALS**

Furnish all materials for temporary support, adequate protection, and maintenance of all underground and surface utility structures, supports, drains, sewer and other obstructions encountered in the progress of the work.

The pipe material to be used for bridge crossings shall be steel or ductile iron as called out in the plans and approved by the Engineer.

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For bridge crossings using steel pipe, all steel pipe to be ASTM A53 Grade "B" submerged arc-welded black steel pipe with ½-inch wall thickness, beveled ends, 50 Mil Pritec (or approved equal) coated exterior, and unlined interior. All steel pipe to be cement lined with 5/16-inch cement mortar lining in accordance with AWWA C602. If lining not installed at factory, in place lining to be performed by contractor or subcontractor approved by owner.

For bridge crossings using ductile iron pipe, all ductile iron pipe to be fully restrained meeting requirements provided in Section 15105 as applicable. All ductile iron pipe to have factory installed cement in accordance with AWWA C110 or epoxy lining in accordance with AWWA C116.

### PART 3 EXECUTION

#### .01 OBSTRUCTIONS BY OTHER UTILITY STRUCTURES

Support, relocate, remove, or reconstruct existing utility structures such as conduits, ducts, pipes, branch connections to main sewers, or drains. The obstruction shall be permanently supported, relocated, removed or reconstructed where they obstruct the grade or alignment of the pipe. Contractor must do so in cooperation with the owners of such utility structures. Before proceeding, the Contractor must reach an agreement with the Engineer on the method to work around the obstruction.

No deviation shall be made from the required line or depth without the consent of the Engineer.

#### .02 REPAIRS

- A. Repair or replace any damage to existing structures, work, materials, or equipment incurred by Contractor's operations.
- B. Repair all damage to streets, roads, curbs sidewalks, highways, shoulders, ditches, embankments, culverts, bridges, trees, shrubs or other public or private property caused by transporting equipment, materials or personnel to or from the work site. Make satisfactory and acceptable arrangements with the persons or agencies having jurisdiction over the damaged property concerning repair or replacement
- C. Brace and support existing pipes or conduits crossing the trench, or otherwise exposed to prevent trench settlement from disrupting the line or grade of the pipe or conduit. Before proceeding, the Contractor must reach an agreement with the Engineer on the method of bracing and support. Repair or replace all utility services broken or damaged at once to avoid inconvenience to customers. Storm sewers shall not be interrupted overnight. Use temporary arrangements, as approved by the

Engineer, until any damaged items can be permanently repaired. Maintain all items damaged or destroyed by construction and subsequently repaired.

### .03 RELOCATION

Relocate existing utilities or structures, where necessary, and restore it to a condition equal to that of the original facility. Obtain approval of the owner of the utility or structure prior to relocating and/or restoring the facility.

### .04 BRIDGE CROSSINGS

- A. Supply cement lined steel or ductile iron pipe, cement or epoxy lined ductile iron or steel pipe fittings, related hardware, equipment, and labor to install water main in a dedicated utility bay beneath the bridge deck. Supply and install all required steel bends from bridge utility bay to meet required alignments to proposed buried DIP.
- B. For steel pipe installation, weld on steel pipe with three (3) passes in accordance with AWWA Standard C206. Supply welded flanges at end(s) of steel pipe for transition from steel pipe to DIP, including all necessary nuts, bolts gaskets, and related hardware. Gaskets to be full faced 1/8-inch thick.
- C. For ductile iron pipe installation, provide at least one support per length of pipe (unless "long span" pipe is utilized). Use the appropriate pressure class of pipe to support the weight of the pipe and its contents. Provide proper lateral and vertical support if needed to prevent "snaking."
- D. If construction of bridge is proposed at the same time as main installation, coordinate all activities with Bridge Contractor and Governing Agency.
- E. Size, supply, and install all required pipe roller supports for attachment to bridge. (Maximum spacing between supports is 10 feet.) Submit shop drawings to owner for approval. If construction of bridge is proposed at the same time as main installation, coordinate installation of pipe roller supports with Bridge Contractor. Supply, install, and coordinate installation of steel sleeves in proposed abutment walls of bridge with Bridge Contractor.

**END OF SECTION 02235**



## SECTION 02317

### EXCAVATION AND BACKFILL FOR UTILITIES

#### PART 1 GENERAL

##### .01 SECTION INCLUDES

- A. Excavation, trenching, foundation, embedment, and backfill for installation of utilities, including manholes and other pipeline structures.

##### .02 DEFINITIONS

- A. Pipe Foundation: Suitable and stable native soils that are exposed at trench subgrade after excavation to depth of bottom of bedding as shown on Drawings, or foundation backfill material placed and compacted in over-excavations.
- B. Embedment Material/Pipe Bedding: Portion of trench backfill that extends vertically from top of foundation up to level line at bottom of pipe, and horizontally from one trench sidewall to opposite sidewall.
- C. Haunching: Material placed on either side of pipe from top of bedding up to springline of pipe and horizontally from one trench sidewall to opposite sidewall.
- D. Initial Backfill: Portion of trench backfill that extends vertically from springline of pipe (top of haunching) up to level line 12 inches above top of pipe, and horizontally from one trench sidewall to opposite sidewall.
- E. Pipe Embedment: Portion of trench backfill that consists of bedding, haunching and initial backfill.
- F. Trench Zone: Portion of trench backfill that extends vertically from top of pipe embedment up to pavement subgrade or up to final grade when not beneath pavement.
- G. Unsuitable Material: Unsuitable soil materials are the following:
  - 1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.
  - 2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.
  - 3. Materials that contain large clods, aggregates, stones greater than 4 inches in any dimension, debris, vegetation, waste or any other deleterious materials.
  - 4. Materials that are contaminated with hydrocarbons or other chemical





contaminants.

- H. Suitable Material: Suitable soil materials are those meeting specification requirements. Materials mixed with lime, fly ash, or cement that can be compacted to required density and meeting requirements for suitable materials may be considered suitable materials, unless otherwise indicated.
- I. Backfill: Suitable material meeting specified quality requirements placed and compacted under controlled conditions.
- J. Ground Water Control Systems: Installations external to trench, such as well points, eductors, or deep wells. Ground water control includes dewatering to lower ground water, intercepting seepage which would otherwise emerge from side or bottom of trench excavation, and depressurization to prevent failure or heaving of excavation bottom.
- K. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from trench excavation. Rain water and surface water accidentally entering trench shall be controlled and removed as part of excavation drainage.
- L. Excavation Drainage: Removal of surface and seepage water in trench by sump pumping and using drainage layer, as defined in ASTM D 2321, placed on foundation beneath pipe bedding or thickened bedding layer of Class I material.
- M. Trench Conditions are defined with regard to stability of trench bottom and trench walls of pipe embedment zone. Maintain trench conditions that provide for effective placement and compaction of embedment material directly on or against undisturbed soils or foundation backfill, except where structural trench support is necessary.
  - 1. Dry Stable Trench: Stable and substantially dry trench conditions exist in pipe embedment zone as result of typically dry soils or achieved by ground water control (dewatering or depressurization) for trenches extending below ground water level.
  - 2. Stable Trench with Seepage: Stable trench in which ground water seepage is controlled by excavation drainage.
    - a. Stable Trench with Seepage in Clayey Soils: Excavation drainage is provided in lieu of or to supplement ground water control systems to control seepage and provide stable trench subgrade in predominately clayey soils prior to bedding placement.
    - b. Stable Wet Trench in Sandy Soils: Excavation drainage is provided in embedment zone in combination with ground water control in predominately sandy or silty soils.
  - 3. Unstable Trench: Unstable trench conditions exist in pipe embedment zone if ground water inflow or high water content causes soil





disturbances, such as sloughing, sliding, boiling, heaving or loss of density.

- N. Sub-trench: Sub-trench is special case of benched excavation. Sub-trench excavation below trench shields or shoring installations may be used to allow placement and compaction of foundation or embedment materials directly against undisturbed soils. Depth of sub-trench depends upon trench stability and safety as determined by Contractor.
- O. Trench Dam: Placement of low permeability material in pipe embedment zone or foundation to prohibit ground water flow along trench.
- P. Over-excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below top of foundation as shown on Drawings, and backfilled with foundation backfill material.
- Q. Foundation Backfill Materials: Natural soil or manufactured aggregate of controlled gradation, and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill to provide stable support for bedding. Foundation backfill materials may include concrete seal slabs.
- R. Trench Safety Systems include both protective systems and shoring systems.
- S. Trench Shield (Trench Box): Portable worker safety structure moved along trench as work proceeds, used as protective system and designed to withstand forces imposed on it by cavein, thereby protecting persons within trench. Trench shields may be stacked if so designed or placed in series depending on depth and length of excavation to be protected.
- T. Shoring System: Structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins, or to prevent movement of ground affecting adjacent installations or improvements.
- U. Special Shoring: Shoring system meeting special shoring as specified in Paragraph 1.08, Special Shoring Design Requirements, for locations identified on Drawings.

### .03 SCHEDULING

- A. Schedule work so that pipe embedment can be completed on same day that acceptable foundation has been achieved for each section of pipe installation, manhole, or other structures.

### .04 SUBMITTALS

- A. Conform to requirements of Section 01300 - Submittal Procedures.
- B. Submit planned typical method of excavation, backfill placement and



compaction including:

1. Trench widths.
  2. Procedures for foundation and pipe zone bedding placement, and trench backfill compaction.
  3. Procedures for assuring compaction against undisturbed soil when pre-manufactured trench safety systems are proposed.
- C. Submit backfill material sources and product quality information in accordance with requirements of Section 02320 - Utility Backfill Materials.
- D. Submit trench excavation safety program. Include designs for special shoring meeting requirements defined in Paragraph 1.06, Special Shoring Design Requirements contained herein.
- E. Submit record of location of utilities as installed, referenced to survey control points. Include locations of utilities encountered or rerouted. Give stations, horizontal dimensions, elevations, inverts, and gradients.
- F. Submit 11 inch by 17 inch or 12 inch by 18 inch copy of Drawing with plotted utility or obstruction location titled "Critical Location Report" to AW Project Manager.

#### .05 TESTS

- A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided by AW.
- B. Perform backfill material source qualification testing in accordance with requirements of Section 02320- Utility Backfill Materials.

#### .06 SPECIAL SHORING DESIGN REQUIREMENTS

- A. Have special shoring designed or selected by Contractor's Professional Engineer registered in the state the project is being completed to provide support for sides of excavations, including soils and hydrostatic ground water pressures as applicable, and to prevent ground movements affecting adjacent installations or improvements such as structures, pavements and utilities. Special shoring may be a premanufactured system selected by Contractor's Professional Engineer to meet project site requirements based on manufacturer's standard design.

## PART 2 PRODUCTS

#### .01 EQUIPMENT

- A. Perform excavation with hydraulic excavator or other equipment suitable



for achieving requirements of this Section.

- B. Use only hand-operated tamping equipment until minimum cover of 12 inches is obtained over pipes, conduits, and ducts. Do not use heavy compacting equipment until adequate cover is attained to prevent damage to pipes, conduits, or ducts.
- C. Use trench shields or other protective systems or shoring systems which are designed and operated to achieve placement and compaction of backfill directly against undisturbed native soil.
- D. Use special shoring systems where required which may consist of braced sheeting, braced soldier piles and lagging, slide rail systems, or other systems meeting requirements as specified in Paragraph 1.08, Special Shoring Design Requirements.

## .02 MATERIAL CLASSIFICATIONS

- A. Embedment and Trench Zone Backfill Materials: Conform to classifications and product descriptions of Section 02320 - Utility Backfill Materials, and Section 2321 – Cement Stabilized Sand.
- B. Concrete Backfill: Conform to requirements for Class B concrete as specified in Concrete for Utility Construction.
- C. Geotextile (Filter Fabric): Conform to requirements of Section 02621- Geotextile.
- D. Concrete for Trench Dams: Concrete backfill or 3 sack premixed (bag) concrete.

## PART 3 EXECUTION

### .01 STANDARD PRACTICE

- A. Install flexible pipe, including "semi-rigid" pipe, to conform to standard practice described in ASTM D 2321, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.
- B. Install rigid pipe to conform to standard practice described in ASTM C 12, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

### .02 PREPARATION

- A. Maintain barricades and warning lights for streets and intersections affected by Work, and that are considered hazardous to traffic movements.
- B. Perform work to conform to applicable safety standards and regulations. Employ trench safety system as specified and as shown on the contract



drawings.

- C. Immediately notify agency or company owning any existing utility line which is damaged, broken, or disturbed. Obtain approval from AW Project Manager and agency for any repairs or relocations, either temporary or permanent.
- D. Remove existing pavements and structures, including sidewalks and driveways, to conform to requirements of Section 02221 - Removing Existing Pavements and Structures, as applicable.
- E. Install and operate necessary dewatering and surface-water control measures. Provide stable trench to allow installation in accordance with Specifications.
- F. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed in writing, replace those which are damaged or destroyed in accordance with Field Surveying.

### .03 CRITICAL LOCATION INVESTIGATION

- A. Horizontal and vertical location of various underground lines shown on Drawings, including but not limited to water lines, gas lines, storm sewers, sanitary sewers, telecommunication lines, electric lines or power ducts, pipelines, concrete and debris, are based on best information available but are only approximate locations. At Critical Locations shown on Drawings, field verify horizontal and vertical locations of such lines within zone 2 feet vertically and 4 feet horizontally of proposed work.
  - 1. Verify location of existing utilities minimum of 7 working days in advance of pipe laying activities based on daily pipe laying rate. Use extreme caution and care when uncovering these lines.
  - 2. Notify AW Project Manager in writing immediately upon identification of obstruction. In event of failure to identify obstruction in minimum of 7 days, Contractor will not be entitled to extra cost for downtime including, but not limited to, payroll, equipment, overhead, demobilization and remobilization, until 7 days has passed from time AW Project Manager is notified of obstruction.
- B. Notify involved utility companies of date and time that investigation excavation will occur and request that their respective utility lines be marked in field. Comply with utility or pipeline company requirements that their representative be present during excavation. Provide AW Project Manager with 48 hours notice prior to field excavation or related work.
- C. Survey vertical and horizontal locations of obstructions relative to project baseline and datum and plot on 12 inch by 18 inch copy of Drawings. For large diameter water lines, submit to AW Project Manager for approval, horizontal and vertical alignment dimensions for connections to existing lines, tied into project baseline, signed and sealed by R.P.L.S registered in



the state the project is being completed.

#### .04 PROTECTION

- A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within grading limits as designated on Drawings.
- B. Protect and support above-grade and below-grade utilities which are to remain.
- C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities is indicated on Drawings.
- D. Take measures to minimize erosion of trenches. Do not allow water to pond in trenches. Where slides, washouts, settlements, or areas with loss of density or pavement failures or potholes occur, repair, recompact, and pave those areas at no additional cost to AW.

#### .05 EXCAVATION

- A. Except as otherwise specified or shown on Drawings, install underground utilities in open cut trenches with vertical sides.
- B. Perform excavation work so that pipe, conduit, and ducts can be installed to depths and alignments shown on Drawings. Avoid disturbing surrounding ground and existing facilities and improvements.
- C. Determine trench excavation widths using following schedule as related to pipe outside diameter (O.D.).

<b>Nominal Pipe Size, Inches</b>	<b>Minimum Trench Width, Inches</b>
Less than 18	O.D. + 18
18 to 30	O.D. + 24
Over 30	O.D. + 24

- D. Use sufficient trench width or benches above embedment zone for installation of well point headers or manifolds and pumps where depth of trench makes it uneconomical or impractical to pump from surface elevation. Provide sufficient space between shoring cross braces to permit equipment operations and handling of forms, pipe, embedment and backfill, and other materials.
- E. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify AW Project Manager and obtain instructions before proceeding.



- F. Shoring of Trench Walls.
1. Install Special Shoring in advance of trench excavation or simultaneously with trench excavation, so that soils within full height of trench excavation walls will remain laterally supported at all times.
  2. For all types of shoring, support trench walls in pipe embedment zone throughout installation. Provide trench wall supports sufficiently tight to prevent washing trench wall soil out from behind trench wall support.
  3. Leave sheeting driven into or below pipe embedment zone in place to preclude loss of support of foundation and embedment materials, unless otherwise directed by AW Project Manager. Leave rangers, walers, and braces in place as long as required to support sheeting, which has been cut off, and trench wall in vicinity of pipe zone.
  4. Employ special methods for maintaining integrity of embedment or foundation material. Before moving supports, place and compact embedment to sufficient depths to provide protection of pipe and stability of trench walls. As supports are moved, finish placing and compacting embedment.
  5. If sheeting or other shoring is used below top of pipe embedment zone, do not disturb pipe foundation and embedment materials by subsequent removal. Maximum thickness of removable sheeting extending into embedment zone shall be equivalent of 1-inch-thick steel plate. As sheeting is removed, fill in voids left with grouting material.
- G. Use of Trench Shields. When trench shield (trench box) is used as worker safety device, the following requirements apply:
1. Make trench excavations of sufficient width to allow shield to be lifted or pulled freely, without damage to trench sidewalls.
  2. Move trench shields so that pipe, and backfill materials, after placement and compaction, are not damaged nor disturbed, nor degree of compaction reduced. Re-compact after shield is moved if soil is disturbed.
  3. When required, place, spread, and compact pipe foundation and bedding materials beneath shield. For backfill above bedding, lift shield as each layer of backfill is placed and spread. Place and compact backfill materials against undisturbed trench walls and foundation.
  4. Maintain trench shield in position to allow sampling and testing to be performed in safe manner.
  5. Conform to applicable Government regulations.
- H. Voids under paving area outside shield caused by Contractor's work will require removal of pavement, consolidation and replacement of pavement in accordance with Contract Documents. Repair damage resulting from failure to provide adequate supports.





- I. Place sand or soil behind shoring or trench shield to prevent soil outside shoring from collapsing and causing voids under pavement. Immediately pack suitable material in outside voids following excavation to avoid caving of trench walls.
- J. Coordinate excavation within 15 feet of pipeline with company's representative. Support pipeline with methods agreed to by pipeline company's representative. Use small, rubber tired excavator, such as backhoe, to do exploratory excavation. Bucket that is used to dig in close proximity to pipelines shall not have teeth or shall have guard installed over teeth to approximate bucket without teeth. Excavate by hand within 1 foot of Pipeline Company's line. Do not use larger excavation equipment than normally used to dig trench in vicinity of pipeline until pipelines have been uncovered and fully exposed. Do not place large excavation and hauling equipment directly over pipelines unless approved by Pipeline Company's representative.
- K. When, during excavation to uncover Pipeline Company's pipelines, screwed collar or an oxyacetylene weld is exposed, immediately notify AW Project Manager. Provide supports for collar or welds. Discuss with Pipeline Company's representative and determine methods of supporting collar or weld during excavation and later backfilling operations. When collar is exposed, request Pipeline Company to provide welder in a timely manner to weld ends of collar prior to backfilling of excavation.

#### .06 HANDLING EXCAVATED MATERIALS

- A. Use only excavated materials, which are suitable as defined in this Section and conforming to Section 02320 - Utility Backfill Materials. Place material suitable for backfilling in stockpiles at distance from trench to prevent slides or cave-ins.
- B. When required, provide additional backfill material conforming to requirements of Section 02320 - Utility Backfill Materials.
- C. Do not place stockpiles of excess excavated materials on streets and adjacent properties. Protect backfill material to be used on site. Excavate trench so that pipe is centered in trench. Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.

#### .07 TRENCH FOUNDATION

- A. Excavate bottom of trench to uniform grade to achieve stable trench conditions and satisfactory compaction of foundation or bedding materials.
- B. When wet soil is encountered on trench bottom and dewatering system is not required, overexcavate an additional 6 inches with approval by AW Project Manager. Place non-woven geotextile fabric and then compact 12 inches of crushed stone in one lift on top of fabric. Compact crushed stone



with four passes of vibratory-type compaction equipment.

- C. Perform over excavation, if directed by AW Project Manager, in accordance with Paragraph 3.07.B above. Removal of material may be required.
  - 1. Even though Contractor has not determined material to be unsuitable, or
  - 2. If unstable trench bottom is encountered and an adequate ground water control system is installed and operating.
- D. Place trench dams in Class I foundations in line segments longer than 100 feet between manholes and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

#### .08 PIPE EMBEDMENT, PLACEMENT, AND COMPACTION

- A. Remove loose, sloughing, caving, or otherwise unsuitable soil from bottoms and sidewalls of trenches immediately prior to placement of embedment materials.
- B. Place embedment including bedding, haunching, and initial backfill as shown on Drawings.
- C. For pipe installation, manually spread embedment materials around pipe to provide uniform bearing and side support when compacted. Protect flexible pipe from damage during placing of pipe zone bedding material. Perform placement and compaction directly against undisturbed soils in trench sidewalls, or against sheeting which is to remain in place.
- D. Do not place trench shields or shoring within height of embedment zone unless means to maintain density of compacted embedment material are used. If moveable supports are used in embedment zone, lift supports incrementally to allow placement and compaction of material against undisturbed soil.
- E. Place geotextile to prevent particle migration from in-situ soil into open-graded (Class I) embedment materials or drainage layers.
- F. Do not damage coatings or wrappings of pipes during backfilling and compacting operations. When embedding coated or wrapped pipes, do not use crushed stone or other sharp, angular aggregates.
- G. Place haunching material manually around pipe and compact it to provide uniform bearing and side support. If necessary, hold small-diameter or lightweight pipe in place during compaction of haunch areas and placement beside pipe with sand bags or other suitable means.
- H. Place electrical conduit, if used, directly on foundation without bedding.
- I. Shovel in-place and compact embedment material using pneumatic





tampers in restricted areas, and vibratory-plate compactors or engine-powered jumping jacks in unrestricted areas. Compact each lift before proceeding with placement of next lift. Water tamping is not allowed.

- J. For water lines construction embedment, use material as specified in Section 02320 - Utility Backfill Material. For water lines adhere to the following subparagraph numbers 1 and 2; for utility installation other than water, adhere to numbers 3 and 4 below:
1. Embedment Materials:
    - a. Maximum 6 inches compacted lift thickness.
    - b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.
    - c. Moisture content to be within -3 percent to +5 percent of optimum as determined according to ASTM D 698, unless otherwise approved by Project Manager.
  2. Cement Stabilized Sand (where required for special installations):
    - a. Maximum 6 inches compacted thickness.
    - b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.
    - c. Moisture content to be on dry side of optimum as determined according to ASTM D 698 but sufficient for effective hydration.
  3. Embedment Materials.
    - a. Maximum 6-inches compacted lift thickness.
    - b. Systematic compaction by at least two passes of vibrating equipment. Increase compaction effort as necessary to effectively embed pipe to meet deflection test criteria.
    - c. Moisture content as determined by Contractor for effective compaction without softening soil of trench bottom, foundation or trench walls.
  4. Embedment and Cement Stabilized Sand.
    - a. Maximum 6-inches compacted thickness.
    - b. Compaction by methods determined by Contractor to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698 for Class II materials and according to ASTM D 558 for cement stabilized materials.
    - c. Moisture content of Class II materials within 3 percent of optimum as determined according to ASTM D 698. Moisture content of cement stabilized sands on dry side of optimum as determined according to ASTM D 558 but sufficient for effective hydration.
- K. Place trench dams in embedment in line segments longer than 100 feet between manholes, and not less than one in every 500 feet of pipe placed.



Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

#### .09 TRENCH ZONE BACKFILL PLACEMENT AND COMPACTION

- A. Place backfill for pipe or conduits and restore surface as soon as practicable. Leave only minimum length of trench open as necessary for construction.
- B. For water lines, under pavement and to within one (1) foot back of curb, use backfill materials described by trench limits.
  - 1. For water lines 20 inches in diameter and smaller use bank run sand or select backfill materials up to pavement base or subgrade.
  - 2. For water lines 24 inch in diameter and larger, backfill with suitable on-site materials (random backfill) up to 12 inches below pavement base or subgrade. Place minimum of 12 inches of select backfill below pavement base or subgrade.
- C. For sewer pipes under pavement and within one foot back of curb, use backfill materials described by trench limits.
  - For sewer pipes 36 inches in diameter and smaller use cement stabilized sand up to pavement base or subgrade.
  - For sewer pipes 42 inches and larger, backfill with suitable on-site material (random backfill) up to 12 inches below pavement base or subgrade. Place minimum of 12 inches of select backfill below pavement base or subgrade.
- D. Where shown on the Drawings, remove unsuitable material from the site and backfill with suitable materials.
- E. Unless otherwise shown on the Drawings, use one of the following trench zone backfills under existing pavement and to within five feet of edge of pavement. Place trench zone backfill in lifts and compact. Fully compact each lift before placement of next lift..
  - 1. Class I, II, or III (or combination thereof):
    - a. Place in maximum 12 inch thick loose layers.
    - b. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 698.
    - c. Moisture content within zero percent to +5 percent of optimum determined according to ASTM D 698, unless otherwise approved by AW Project Manager.
  - 2. Cement-Stabilized Sand:
    - a. Maximum lift thickness determined by Contractor to achieve uniform placement and required compaction, but do not exceed 12 inches.



- b. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 558.
  - c. Moisture content on dry side of optimum determined according to ASTM D 558 but sufficient for cement hydration.
- 3. Clay Soils:
  - a. Place in maximum 8-inch thick loose layers.
  - b. Compact by vibratory Sheepsfoot Roller to minimum of 95 percent of maximum dry density determined according to ASTM D 698.
  - c. Moisture content within zero percent below or +5 percent above optimum determined according to ASTM D 698, unless approved by Project Manager.
- F. Unless otherwise shown on Drawings, for trench excavations not under pavement, random backfill of suitable material may be used in trench zone.
  - 1. Clay Soils may be used as trench zone backfill outside paved areas.
  - 2. Place in maximum 12-inch loose thick loose lift.
  - 3. Compact to minimum of 90 percent of maximum dry density determined according to ASTM D 698.
  - 4. Moisture content as necessary to achieve density.
- G. For electric conduits, remove form work used for construction of conduits before placing trench zone backfill.

#### .010 MANHOLES, JUNCTION BOXES AND OTHER PIPELINE STRUCTURES

- A. Encapsulate manhole, junction box and other pipeline structures with cement stabilized sand, minimum one (1) foot below base, minimum one (1) foot around walls, up to within 12 inches of pavement subgrade. Compact in accordance with Paragraph 3.9.F.3 of this Section.

#### .011 FIELD QUALITY CONTROL

- A. Test for material source qualifications as defined in Section 02320 - Utility Backfill Materials.
- B. Provide excavation and trench safety systems at locations and to depths required for testing and retesting during construction at no additional cost to AW.
- C. Tests will be performed on minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with ASTM D 422. Additional classification tests will be performed whenever there is noticeable change in material gradation or plasticity, or when requested by AW Project Manager.



- D. At least three tests for moisture-density relationships will be performed initially for backfill materials in accordance with ASTM D 698, and for cement- stabilized sand in accordance with ASTM D 558. Perform additional moisture-density relationship tests once a month or whenever there is noticeable change in material gradation or plasticity.
- E. In-place density tests of compacted pipe foundation, embedment and trench zone backfill soil materials will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at following frequencies and conditions.
  - 1. For open cut construction projects and auger pits: Unless otherwise approved by AW Project Manager, successful compaction to be measured by one test per 40 linear feet measured along pipe for compacted embedment and two tests per 40 linear feet measured along pipe for compacted trench zone backfill material. Length of auger pits to be measured to arrive at 40 linear feet.
  - 2. A minimum of three density tests for each full shift of Work.
  - 3. Density tests will be distributed among placement areas. Placement areas are: foundation, bedding, haunching, initial backfill and trench zone.
  - 4. The number of tests will be increased if inspection determines that soil type or moisture content are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density, as specified.
  - 5. Density tests may be performed at various depths below fill surface by pit excavation. Material in previously placed lifts may therefore be subject to acceptance/rejection.
  - 6. Two verification tests will be performed adjacent to in-place tests showing density less than acceptance criteria. Placement will be rejected unless both verification tests show acceptable results.
  - 7. Recompact placement will be retested at same frequency as first test series, including verification tests.
- F. Recondition, recompact, and retest at Contractor's expense if tests indicate Work does not meet specified compaction requirements. For hardened soil cement with nonconforming density, core and test for compressive strength at Contractor's expense.
- G. Acceptability of crushed rock compaction will be determined by inspection.

#### .012 DISPOSAL OF EXCESS MATERIAL

- A. Dispose of excess materials in accordance with requirements of the contract documents.

### END OF SECTION 02317



## SECTION 02320

### UTILITY BACKFILL MATERIALS

#### PART 1 GENERAL

##### .01 SECTION INCLUDES

- A. Material Classifications.
- B. Utility Backfill Materials: 1) Concrete sand 2) Gem sand 3) Pea gravel 4) Crushed stone 5) Crushed concrete 6) Bank run sand 7) Select backfill 8) Random backfill
- C. Material Handling and Quality Control Requirements.

##### .02 DEFINITIONS

- A. Unsuitable Material:
  - 1. Materials classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.
  - 2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.
  - 3. Materials containing large clods, aggregates, or stones greater than 4 inches in any dimension; debris, vegetation, or waste; or any other deleterious materials.
  - 4. Materials contaminated with hydrocarbons or other chemical contaminants.
- B. Suitable Material:
  - 1. Materials meeting specification requirements.
  - 2. Unsuitable materials meeting specification requirements for suitable soils after treatment with lime or cement.
- C. Foundation Backfill Materials: Natural soil or manufactured aggregate meeting Class I requirements and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill where needed to provide stable support for structure foundation base. Foundation backfill materials may include concrete fill and seal slabs.
- D. Foundation Base: Crushed stone aggregate with filter fabric as required, cement stabilized sand, or concrete seal slab.



- E. Backfill Material: Classified soil material meeting specified quality requirements for designated application as embedment or trench zone backfill.
- F. Embedment Material: Material as specified herein and as shown on construction details SD54 and SD55; unless otherwise approved in advance by AW. Bedding materials shall be placed under controlled conditions within embedment zone extending vertically upward from top of foundation to an elevation 12 inches above top of pipe, and including pipe bedding, haunching and initial backfill.
- G. Trench Zone Backfill: Classified soil material meeting specified quality requirements and placed under controlled conditions in trench zone from top of embedment zone to base course in paved areas or to surface grading material in unpaved areas.
- H. Foundation: Either suitable soil of trench bottom or material placed as backfill of overexcavation for removal and replacement of unsuitable or otherwise unstable soils.
- I. Source: Source selected by Contractor for supply of embedment or trench zone backfill material. Selected source may be project excavation, off site borrow pits, commercial borrow pits, or sand and aggregate production or manufacturing plants.
- J. Refer to Section 02317 - Excavation and Backfill for Utilities for other definitions regarding utility installation by trench construction.

### .03 SUBMITTALS

- A. Conform to requirements of Section 01300 - Submittal Procedures.
- B. Submit description of source, material classification and product description, production method, and application of backfill materials.
- C. Submit test results for samples of off-site backfill materials. Comply with Paragraph 2.03, Material Testing.
- D. Before stockpiling materials, submit copy of approval from landowner for stockpiling backfill material on private property.
- E. Provide delivery ticket which includes source location for each delivery of material that is obtained from off site sources or is being paid as specific bid item.





## .04 TESTS

- A. Perform tests of sources for backfill material in accordance with Paragraph 2.03B.
- B. Verification tests of backfill materials may be performed by AW in accordance with Paragraph 3.03.

## PART 2 PRODUCTS

### .01 MATERIAL CLASSIFICATIONS

- A. Classify materials for backfill for purpose of quality control in accordance with Unified Soil Classification Symbols as defined in ASTM D 2487. Material use and application is defined in utility installation specifications and Drawings either by class, as described in Paragraph 2.01 B, or by product descriptions, as given in Paragraph 2.02.
- B. Class Designations Based on Laboratory Testing:
  - 1. Class I: Well-graded gravels and sands, gravel-sand mixtures, crushed well-graded rock, little or no fines (GW, SW):
    - a. Plasticity index: non-plastic.
    - b. Gradation: D60/D10 - greater than 4 percent; amount passing No. 200 sieve - less than or equal to 5 percent.
  - 2. Class II: Poorly graded gravels and sands, silty gravels and sands, little to moderate fines (GM, GP, SP, SM):
    - a. Plasticity index: non-plastic to 4.
    - b. Gradations:
      - 1) Gradation (GP, SP): amount passing No. 200 sieve - less than 5 percent.
      - 2) Gradation (GM, SM): amount passing No. 200 sieve - between 12 percent and 50 percent.
      - 3) Borderline gradations with dual classifications (e.g., SP-SM): amount passing No. 200 sieve - between 5 percent and 12 percent.
  - 3. Class III: Clayey gravels and sands, poorly graded mixtures of gravel, sand, silt, and clay (GC, SC, and dual classifications, e.g., SP-SC):
    - a. Plasticity index: greater than 7.
    - b. Gradation: amount passing No. 200 sieve - between 12 percent and 50 percent.
  - 4. Class IVA: Lean clays (CL).



- a. Plasticity Indexes:
    - 1) Plasticity index: greater than 7, and above A line.
    - 2) Borderline plasticity with dual classifications (CL-ML): PI between 4 and 7.
  - b. Liquid limit: less than 50.
  - c. Gradation: amount passing No. 200 sieve - greater than 50 percent.
  - d. Inorganic.
5. Class IVB: Fat clays (CH)
- a. Plasticity index: above A line.
  - b. Liquid limit: 50 or greater.
  - c. Gradation: amount passing No. 200 sieve - greater than 50 percent.
  - d. Inorganic.
6. Use soils with dual class designation according to ASTM D 2487, and which are not defined above, according to more restrictive class.

## .02 PRODUCT DESCRIPTIONS

- A. Soils classified as silt (ML) silty clay (CL-ML with PI of 4 to 7), elastic silt (MH), organic clay and organic silt (OL, OH), and organic matter (PT) are not acceptable as backfill materials. These soils may be used for site grading and restoration in unimproved areas as approved by AW Project Manager. Soils in Class IV B, fat clay (CH) may be used as backfill materials where allowed by applicable backfill installation specification. Refer to Section 02316 - Excavation and Backfill for Structures and Section 02317 - Excavation and Backfill for Utilities.
- B. Provide backfill material that is free of stones greater than 6 inches, free of roots, waste, debris, trash, organic material, unstable material, non-soil matter, hydrocarbon or other contamination, conforming to following limits for deleterious materials:
  - 1. Clay lumps: Less than 0.5 percent for Class I, and less than 2.0 percent for Class II, when tested in accordance with ASTM C 142.
  - 2. Lightweight pieces: Less than 5 percent when tested in accordance with ASTM C 123.
  - 3. Organic impurities: No color darker than standard color when tested in accordance with ASTM C 40.
- C. Manufactured materials, such as crushed concrete, may be substituted for natural soil or rock products where indicated in product specification,





and approved by AW Project Manager, provided that physical property criteria are determined to be satisfactory by testing.

- D. Bank Run Sand: Durable bank run sand classified as SP, SW, or SM by Unified Soil Classification System (ASTM D 2487) meeting following requirements:
  - 1. Less than 15 percent passing number 200 sieve when tested in accordance with ASTM D 1140. Amount of clay lumps or balls may not exceed 2 percent.
  - 2. Material passing number 40 sieve shall meet the following requirements when tested in accordance with ASTM D 4318: Plasticity index: not exceeding 7.
- E. Concrete Sand: Natural sand, manufactured sand, or combination of natural and manufactured sand conforming to requirements of ASTM C 33 and graded within following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
3/8"	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10



- F. Gem Sand: Sand conforming to requirements of ASTM C 33 for course aggregates specified for number 8 size and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
3/8"	95 to 100
No. 4	60 to 80
No. 8	15 to 40

- G. Pea Gravel: Durable particles composed of small, smooth, rounded stones or pebbles and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
1/2"	100
3/8"	85 to 100
No. 4	10 to 30
No. 8	0 to 10
No. 16	0 to 5

- H. Crushed Aggregates: Crushed aggregates consist of durable particles obtained from an approved source and meeting the following requirements:
1. Materials of one product delivered for same construction activity from single source, unless otherwise approved by AW Project Manager.
  2. Non-plastic fines.
  3. Los Angeles abrasion test wear not exceeding 45 percent when tested in accordance with ASTM C 131.
  4. Crushed aggregate shall have minimum of 90 percent of particles retained on No. 4 sieve with 2 or more crushed faces.
  5. Crushed stone: Produced from oversize plant processed stone or gravel, sized by crushing to predominantly angular particles from naturally occurring single source. Uncrushed gravel is not acceptable materials for embedment where crushed stone is shown on applicable utility embedment drawing details.
  6. Crushed Concrete: Crushed concrete is an acceptable substitute for crushed stone as utility backfill. Gradation and quality control test requirements are same as crushed stone. Provide crushed concrete produced from normal weight concrete of uniform quality; containing

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particles of aggregate and cement material, free from other substances such as asphalt, reinforcing steel fragments, soil, waste gypsum (calcium sulfate), or debris.

7. Gradations, as follows:

Sieve	Percent Passing by Weight for Pipe Embedment by Ranges of Nominal Pipes Sizes		
	>15"	15" - 8"	< 8"
1"	95 - 100	100	
3/4"	60 - 90	90 - 100	100
1/2"	25 - 60	-	90 - 100
3/8"	-	20 - 55	40 - 70
No.4	0 - 5	0-10	0-15
No. 8	-	0 - 5	0 - 5

- I. Select Backfill: Class III clayey gravel or sand or Class IV lean clay with plasticity index between 7 and 20 or clayey soils treated with lime in accordance with Section 02951 - Pavement Repair and Resurfacing, to meet plasticity criteria.
- J. Random Backfill: Any suitable soil or mixture of soils within Classes I, II, III and IV; or fat clay (CH) where allowed by applicable backfill installation specification. Refer to Section 02316 - Excavation and Backfill for Structures and Section 02317 - Excavation and Backfill for Utilities.
- K. Cement Stabilized Sand: Conform to requirements of Section 02321 - Cement Stabilized Sand.
- L. Concrete Backfill: Conform to Class B concrete as specified in Section 03315 - Concrete for Utility Construction.
- M. Flexible Base Course Material: Conform to requirements of applicable portions of Section 02711 - Hot Mix Asphaltic Base Course, Section 02712 - Cement Stabilized Base Course.

### .03 MATERIAL TESTING

- A. Source Qualification. Perform testing to obtain tests by suppliers for selection of material sources and products not from the project site. Test samples of processed materials from current production representing material to be delivered. Use tests to verify that materials meet specification requirements. Repeat qualification test procedures each time source characteristics change or there is planned change in source

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location or supplier. Include the following qualification tests, as applicable:

1. Gradation. Report complete sieve analyses regardless of specified control sieves from largest particle through No. 200 sieve.
  2. Plasticity of material passing No. 40 sieve
  3. Los Angeles abrasion wear of material retained on No. 4 sieve
  4. Clay lumps
  5. Lightweight pieces
  6. Organic impurities
- B. Production Testing. Provide reports to AW Project Manager from an independent testing laboratory that backfill materials to be placed in Work meet applicable specification requirements.
- C. Assist AW Project Manager in obtaining material samples for verification testing at source or at production plant.

## **PART 3 EXECUTION**

### **.01 SOURCES**

- A. Use of existing material in trench excavations is acceptable, provided applicable specification requirements are satisfied.
- B. Identify off-site sources for backfill materials at least 14 days ahead of intended use so that AW Project Manager may obtain samples for verification testing.
- C. Materials may be subjected to inspection or additional verification testing after delivery. Materials which do not meet requirements of specifications will be rejected. Do not use material which, after approval, has become unsuitable for use due to segregation, mixing with other materials, or by contamination. Once material is approved by AW Project Manager, expense for sampling and testing required to change to different material will be credited to AW through change order.
- D. Bank ran sand, select backfill, and random backfill, if available in project excavation, may be obtained by selective excavation and acceptance testing. Obtain additional quantities of these materials and other materials required to complete work from off-site sources.
- E. AW does not represent or guarantee that any soil found in excavation work will be suitable and acceptable as backfill material.



## .02 MATERIAL HANDLING

- A. When backfill material is obtained from either commercial or non-commercial borrow pit, open pit to expose vertical faces of various strata for identification and selection of approved material to be used. Excavate selected material by vertical cuts extending through exposed strata to achieve uniformity in product.
- B. Establish temporary stockpile locations for practical material handling, control, and verification testing by AW Project Manager in advance of final placement. Obtain approval from landowner for storage of backfill material on adjacent private property.
- C. When stockpiling backfill material near project site, use appropriate covers to eliminate blowing of materials into adjacent areas and prevent runoff containing sediments from entering drainage system.
- D. Place stockpiles in layers to avoid segregation of processed materials. Load material by making successive vertical cuts through entire depth of stockpile.

## .03 FIELD QUALITY CONTROL

- A. Quality Control
  - 1. The AW Project Manager may sample and test backfill at:
    - a. Sources including borrow pits, production plants and Contractor's designated off-site stockpiles.
    - b. On-site stockpiles.
    - c. Materials placed in Work.
  - 2. The AW Project Manager may re-sample material at any stage of work or location if changes in characteristics are apparent.
- B. Production Verification Testing: AW's testing laboratory will provide verification testing on backfill materials, as directed by AW Project Manager. Samples may be taken at source or at production plant, as applicable.

**END OF SECTION**



## SECTION 02458

### LARGE SCALE HORIZONTAL DIRECTIONAL DRILLING (HDD) (Projects greater than 250 feet or pipe size greater than 12 inch)

#### PART 1 GENERAL

##### .01 SCOPE

- A. Furnish all labor, materials, tools and equipment as necessary to construct a pipeline crossing by the horizontal directional drilling method. Furnish all labor, equipment, materials and supplies and perform all work necessary to provide American Water with a complete, finished water main crossing. The finished work includes proper installation testing, restoration of underground utilities and environmental protection and restoration.

##### .02 RELATED SECTIONS

Submittals – Section 01300  
Excavation, Backfilling and Compaction – Section 02200  
Piping - General Provisions - Section 15000  
Disinfecting Pipelines – Section 15020

##### .03 QUALITY ASSURANCE:

- A. The HDD equipment operator(s) shall be trained to operate the specific Horizontal Directional Drilling equipment for AW's project with at least 3 years experience in directional drilling obtained within the last five years. All pipe and appurtenances of similar type and material shall be furnished by a single manufacturer.
- B. Perform HDD operations under the constant direction of a drilling supervisor who shall remain on site and be in responsible charge throughout the drilling operation. The Contractor's supervisor shall have supervised directional drilling of a minimum of 5,000 linear feet of pipe of a similar or greater diameter, of similar material, over similar lengths, and with similar subsurface conditions.
- B. The requirements set forth in this Specification specify a wide range of procedural precautions necessary to insure that the basic, essential aspects of a proper Directional Bore installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in



this Specification.

- C. Perform the work in general conformance with ASTM Standard F1962-05, current revision, "Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacles, Including River Crossings."
- D. Adhere to the specifications; any changes must be expressly approved by the AW Project Manager. Approval of any aspect of any Directional Bore operation covered by this Specification shall in no way relieve the Contractor of its ultimate responsibility for the satisfactory completion of the work authorized under the Contract.

#### **.04 PROFILES AND TOPOGRAPHY**

- A. Contours, topography and profiles of the ground as may be shown on the Contract Drawings are believed to be reasonably correct, but are not guaranteed to be absolutely so and are presented only as an approximation. It is the Contractor's responsibility to verify all elevations required to successfully complete the crossing.

#### **.05 SUBMITTALS**

- A. Prior to beginning work, submit to AW copies of a report of schedules, calculations, procedures and any supplemental subsurface soil condition investigations performed along the path of the proposed crossing. Number of copies of the report shall be as specified in Section 01300. The report will summarize the subsurface conditions that are known to the Contractor and that his proposed crossing procedure is based upon factual, best available information. If the subsurface conditions are known to the Contractor by previous work or geotechnical studies done in the immediate area, the information shall be recorded in the report along with any additional geotechnical studies performed by the Contractor. The report shall include the following:

- 1. Subsurface Information

- a. Record in the report subsurface conditions known to the Contractor by previous work or prior geotechnical studies performed in the immediate project area.
    - b. Boring information obtained by AW, if any, is listed in the Supplementary Conditions section of these Specifications.
    - c. Additional borings performed by the Contractor and analysis of soils





along the path of the proposed crossing. The Contractor shall be responsible for obtaining and including in his bid price the cost of any additional borings along the pipe alignment which may be necessary to design the proposed directionally drilled crossing.

At a minimum any supplemental borings performed by the Contractor shall include standard classification of soils, standard penetration tests, split spoon sampling and sieve analysis. Test borings shall be performed to a minimum depth of ten (10) feet below the proposed pipe invert unless rock is encountered in which case test borings shall penetrate at least two feet into rock.

## 2. Drilling Equipment and Methods

- a. Submit information on equipment and written procedure with working drawings describing in detail the proposed boring method and the entire operation to be used. This shall include, but not be limited to, entry and exit pits; settlement pit; size, capacity and arrangement of drilling and pulling equipment; layout of carrier pipe; details and spacing of pipe rollers; type of current head; method of monitoring and controlling line and grade; method of detection of surface movement; and layout of any proposed construction staging areas.
- b. In addition, submit for approval nameplate data for the drilling equipment, mobile spoils removal unit, and Material Safety Data Sheets (MSDS) information for the drilling slurry compounds. This must be submitted and reviewed by AW before work can proceed.

## 3. Piping

Submit shop drawings showing the pipe lengths, design details, joint details, etc. for AW's review. Submittals shall include, but are not limited to, the following:

- a. All welding or fusion procedures to be used in fabrication of the different pipe materials and installation methods.
- b. Certified records for hydrostatic testing of all pipe materials to be used.
- c. An affidavit stating that all pipe materials furnished under this section have been manufactured in the United States of America and comply with all applicable provisions of referenced AWWA standards.





#### 4. Proposed Alignment

Submit a graph in plan and profile plotting the pilot drilling hole alignment to AW for review, including entry/exit angles and radius of curvature. After completion of the crossing, submit a final pipe alignment.

#### 5. Schedule

Time schedule for completing the Directional Bore, including any delays due to anticipated soil conditions.

#### 6. Calculations

- a. Submit detailed design calculations for several representative loading conditions for the proposed crossing. If requested by AW, submit calculations to support the design of any particular location of pipe anywhere along the length of the crossing at no additional cost to AW.
- b. Design calculations shall be presented in a neat, readable format, with all figures, values and units included to facilitate ease of verification.
- c. Calculations shall be submitted to demonstrate that the pipe thickness design is sufficient to meet all design criteria specified.
- d. Calculations shall address the following loading conditions:
  - i) Pre-installation:

Hoop and longitudinal stress during hydrostatic test; spanning stress with pipe full of water and supported on installation rollers, and maximum roller / support spacing.
  - ii) Installation/Post-Installation

Longitudinal stress from pulling force; longitudinal curvature stress at point of entry and in final position; external pressure from drilling fluid, overburden, and loads from the obstacle being crossed.
  - iii) Post-Installation/In-Service



Hoop and longitudinal stress during hydrostatic test; internal working and surge pressure; buckling with internal vacuum.

- e. Perform and submit to AW fluids pressure versus overburden strength calculations. These calculations shall be performed to determine minimum acceptable cover requirements and prevent drilling fluids breakout to the ground surface.
- f. All calculations shall bear the seal of a Registered Professional Engineer. Licensure in the State that the work is performed is preferred.

B. Approval

- 1. No work shall commence without approval by AW. Details and design calculations shall be submitted and approved well in advance of the drilling operation to prevent delays in work. All final layout work, including grades, shall be the Contractor's responsibility.

**.06 JOB CONDITIONS:**

- A. Any nighttime work is strictly regulated and will be allowed only with prior approval granted by AW subject to regulatory agencies having jurisdiction. All crossing operations shall be accomplished during daylight hours, unless approved by AW. Crossing work shall not begin after the hour pre-established as the latest starting time that will allow completion during daylight hours, unless approved by AW. The Contractor shall provide a Work Plan submittal indicating its proposed hours of operation and length of work week. All work plans shall be subject to compliance with all applicable regulatory requirements for construction activities and any off site impacts.
- B. When hazards of night time work are carefully considered and determined to be insignificant, night time work may be allowed only to complete a properly planned crossing, and only if in the opinion of AW the delay was caused by reasonably unavoidable circumstances, and that such night time work is necessary to avoid placing an undue economic hardship on the Contractor.
- C. In emergency situations, or where delay would increase the likelihood of a failure, nighttime work may be allowed to complete a delayed crossing.
- D. All operations shall continue on a 24-hour per day basis during pipe pull back.



## **.07 COORDINATION OF WORK**

- A. Coordinate connections to existing pipelines that require shutdown of AW facilities. AW will designate the time for these connections that could involve work during evenings, nights, Saturdays, Sundays, or holidays. Method of connection and designated times are to cause the least amount of disruption to AW'S water service to its customers. The cost for connections is to be included in the contract price. No contract price adjustment will be allowed for overtime, premium time, or other related costs.

## **.08 USE OF EXISTING WATER SYSTEMS:**

- A. All use of existing water systems during construction by the Contractor shall be with the approval and direction of AW and its representatives. The Contractor shall be responsible for all permits, fees, temporary piping, temporary meter rental/provisions, temporary backflow preventer rental/provision and other water utility requirements for supplying water during construction. The Contractor shall use the existing water system only at locations, times and conditions as set forth by AW or its representatives.
- B. If water is not readily available at the site or AW cannot provide the volume of flow required by the Contractor, provide potable water as needed from an off-site location at no additional cost to AW.

## **PART 2 PRODUCTS**

### **.01 PIPE**

Unless otherwise specified in the Contract Documents, pipe installed by horizontal directional drilling shall either be high density polyethylene pipe (HDPE) or ductile iron pipe specifically designed for directional drilling. Unless otherwise specified in the Contract Documents, the water main pipe (carrier pipe) shall be installed without a casing pipe.

#### **A. POLYETHYLENE PIPE**

- 1. High Density Polyethylene (HDPE) Pipe, AWWA C-906 compliant, NSF 61 Standard Listed, and furnished in fifty (50) foot lengths.
- 2. Polyethylene pipe shall be furnished with an outside diameter conforming to ductile iron pipe sizes. Minimum thickness of HDPE pipe shall be determined by the contractor's calculations, but shall not be considering in-service loading shall not be less than DR 11 when measured in accordance with ASTM D-2122.



3. All polyethylene pipe and fittings shall be made of a high-density polyethylene pipe compound with extra high molecular weight that meets the requirements for Type III, Grade P34 Polyethylene material as defined in ASTM D-1248, latest revision.
4. Pipes shall be jointed to one another and to polyethylene fittings by thermal butt-fusion or by socket fusion in accordance with ASTM D-3261.
5. Joining of pipe sections shall be performed in accordance with the procedures recommended by the pipe manufacturer. Joints between pipe sections shall be smooth on the inside and internal projection beads shall not be greater than 3/16-inch.
6. The tensile strength at yield of the butt-fusion joints shall not be less than the pipe. A specimen of pipe cut across the butt-fusion joint shall be tested in accordance with ASTM D-638.
7. Polyethylene pipe shall be joined to ductile iron pipe by the use of flange adapters and back-up rings. Flange adapters shall be butt fused to the polyethylene carrier pipe. The face of the flange adapter shall have a serrated sealing face to assist in holding the flange gasket in place. Flange gaskets shall be full-faced neoprene. Back-up rings shall be Class "D" steel ring flanges in accordance with AWWA C207. Flange bolts must span the entire width of the flange joint, and provide sufficient thread length to fully engage the nut.

#### B. DUCTILE IRON PIPE

1. Utilize ductile iron pipe equipped with low profile flexible restrained joints such as Flex Ring or TR Flex. Gripping push on joint gaskets, or restrained joint gaskets are not permitted.
2. All ductile iron pipe shall be installed per DIPRA's Horizontal Directional Drilling with Ductile Iron Pipe Handbook to include strict adherence to maximum joint deflection allowances

#### C. THICKNESS DESIGN

The following design criteria shall be used in calculating pipe thickness for HDPE, steel, or ductile iron pipe:

Working Pressure

**\*\*insert working pressure\*\*** PSI

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Test Pressure	<b>**insert test pressure**</b> PSI
Surge Pressure	Working pressure + 100 psi
Dead Load	Earth cover as shown on Drawings, but not less than 15 feet.
Buckling Design	Considering dead load, internal vacuum, H-20 Wheel Loading and a hydrostatic load over top of pipe to grade.
Max. Allowable Horizontal Deflection	3%
Radius of Curvature	90% of Actual Design Radius
Downhole Friction Factor	1.0
Factor of Safety for Drilling Fluid Density	1.5

The stresses in the pipe shall be calculated for the pre-installation, installation, and post installation loading conditions specified in Part 1 of this Specification Section. Thickness shall be selected so that stresses do not exceed the following under any of the loading conditions.

- All conditions except internal surge pressure 50% of minimum yield point
- Internal surge pressure condition 75% of minimum yield point

The contractor shall increase the minimum "in-service" thickness as necessary to support the expected stresses and loadings which are expected to be encountered during the installation of the HDD pipeline. The final selected thickness shall be supported by calculations as required herein. No additional cost shall be considered by AW for pipe thickness greater than the specified minimum "in-service" thickness.

#### D. DEVIATIONS

Should the Contractor choose to submit a bid using material that does not meet all the requirements of these specifications, include a description of the deviation with data showing the magnitude of the deviation. Acceptance of such deviations to these specifications shall be subject to the review and approval of AW before a contract can be awarded.

#### E. INSPECTION OF PIPE

All pipe and fittings used in the work may be factory inspected by a recognized



agency engaged by AW. Inform AW and the inspection agency of the name and address of the manufacturing plant or other sources of materials to be used in the work and shall coordinate with the manufacturer to assure that the inspection agency has access at the manufacturer's plant and adequate assistance and notice so that each item may be examined. All reports will be made to AW and the cost of the services of the inspection agency will be borne by AW. Such inspection by AW shall not relieve the Contractor of his responsibility to furnish materials in accordance with the applicable standards.

## **.02 EQUIPMENT**

- A. General: All equipment for the Directional Bore shall have the capacity, stability, and necessary safety features required to fully comply with the specifications and requirements of this section without showing evidence of undue stress or failure. It shall be the responsibility of the Contractor to assure that the equipment to be used in the Directional Bore is in sound operating condition. Backup equipment shall be required in the event of an equipment breakdown and where the condition of the equipment to be used indicates that routine component replacement or repair will likely be necessary during the Directional Bore.
- B. Directional Drilling System: The directional drilling system shall consist of over the road transportable field power unit, mud-mixing and recycling unit, a trailer or carriage-mounted drill unit, and all other support accessory vehicles and equipment. All system components shall be in sound operating condition with no broken welds, excessively worn parts, badly bent, or otherwise misaligned components. All drill pipe, reamers, pull back heads, swivels, drill heads and collars, pipe cradles, pipe rollers, ropes, cables, clamps, and other non-mechanical but essential items shall be in sound condition and replaced immediately when need is apparent. The equipment must be capable of drilling the specified length in a single bore.
  - 1. Mud-Mixing and Recycle Units: The mud-mixing and recycle unit shall be a self-contained system designed to provide a supply of high-pressure bentonite based cutting fluid to the drill unit. It shall contain a fluid storage tank and a complete bentonite and drilling fluid additive(s) mixing system. The cutting fluid is to be mixed on site. The cutting fluid shall be formulated for this specific project and anticipated conditions. It shall permit changes to be made to the bentonite and drilling fluid additive(s) concentrations during drilling in response to changing soil conditions. The field power unit shall contain the power-taken off-driven high pressure cutting fluid pumping system. The recycle units shall be of a capacity to



minimize the production of new cutting fluid and maximize the reuse and recirculation of original cutting fluid produced.

2. Directional Drill System: A carriage-mounted version of the drill system shall include a thrust frame. Both the trailer-mounted and carriage-mounted drill system shall be designed to rotate and push 10-foot (3-meter) minimum hollow drill sections into the tunnel being created by the boring head. The drill sections shall be made of a high strength S-grade steel that permits them to bend to a 30-foot (9-meter) radius without yielding. Drill end fittings shall permit rapid makeup of the drill sections while meeting the torque, pressure and lineal load requirements of the system. The boring head itself shall be capable of housing a probe used by the Magnetic Guidance System (MGS) to determine tool depth and location from surface and to orient the head for steering. The MGS shall have a minimum accuracy of plus (+) or minus (-) two (2) percent of the vertical depth.

The drilling equipment must be fitted with a permanent alarm system capable of detecting an electric current. The system will have an audible alarm to warn the operator when the drill head nears electrified cables. The drilling equipment shall be grounded, protected, and operated in accordance with manufacturer's requirements for electric strike safety.

The control console shall contain a calibrated display of inclination, azimuth, tool face location, mud pump rates, and torque pressures. The downhole steering system accuracy shall be plus or minus one percent ( $\pm 1.0\%$ ) of the horizontal bore length such that the difference between actual depth and machine calculated depth is not more than 1 foot per hundred feet.

3. Restrictions: Other devices or utility placement systems for providing horizontal thrust other than those previously defined in the preceding sections shall not be used unless approved by AW prior to commencement of the work. The proposed device or system will be evaluated prior to approval or rejection on its potential ability to complete the pipe placement satisfactorily without undue stoppage and to maintain line and grade within the tolerances prescribed by the particular condition of the project. Water sluicing methods, jetting with compressed air, or boring or tunneling devices with vibrating type heads that do not provide positive control of the line and grade shall not be allowed.

- C. Spoils Equipment: The cutting fluid removal system shall include a self-contained vacuum truck which has sufficient vacuum and tank capacity to remove excess cutting fluid mixture and cuttings from the project site as





required or directed by AW. Spoils are not to be discharged into sewers or storm drains.

The Contractor will contain all drilling and pipe lubricating mud by taking special measures to prevent run-off into adjacent properties and/or waterways. All surplus drilling and pipe lubricating mud will be removed from the site and properly disposed of by the Contractor. The Contractor will also be responsible for all required erosion control measures.

- D. Magnetic Guidance System: A Magnetic Guidance System (MGS) probe and location of the drill head during the drilling operation. The tracker shall be capable of tracking at all depths up to one hundred feet and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). The tracker shall be accurate to  $\pm 2\%$  of the vertical depth of the borehole at sensing position at depths up to one hundred feet. Ferrous materials shall not influence or affect the MGS readings or accuracy.

Components: The Contractor shall supply all components and materials to install, operate, and maintain the MGS. This shall include, but not be limited to the following:

- X MGS Probe and Interface
- X Computer, Printer, and Software
- X DC Power Source, Current Control Box, and Coil/Tracking Wire.

The Magnetic Guidance System (MGS) shall be a Tensor TruTracker MGS, or other licensed and industry approved wire guidance system. AW shall be advised of the unit to be used and is subject to his approval. Set up and operate the MGS using personnel experienced with this system. "Walk-over" tracking systems shall not be used, except as approved by AW. Contractor shall provide Engineer with current calibration certification of MGS in accordance with manufacturer's specifications.

- E. If equipment breakdown or other unforeseen stoppages occur and forward motion of the directional cutting head is halted at any time other than for reasons planned in advance (addition of drill stems, etc.), the boring path shall be filled with a proper bentonite solution immediately, or as directed by AW.
- F. The boring tool shall have steering capability and have an electronic tool detection system. The position of the tool during operation shall be capable of being determined accurately, horizontally within 1% of the





horizontal distance of the borehole and vertically within 2% of the vertical depths of the borehole. The boring tool shall have a nominal steering radius of 9 meters (30 feet).

**.03 DRILLING FLUIDS:**

- A. A mixture of Bentonite drilling clay, project specific cutting fluid additives, and potable water is to be used as the cutting fluid (MUD) and over ream hole filler for the Directional Bore. The drilling fluid mixture used shall have the following minimum viscosities as measured by a March Funnel:

Rock Clay	60 sec.
Hard Clay	40 sec.
Soft Clay	45 sec.
Sandy Clay	90 sec.
Stable Sand	120 sec.
Loose Sand	150 sec.
Wet Sand	150 sec.

These viscosities may be varied to best fit the soil conditions encountered as recommended by the drilling mud and fluid additive manufacturer, and as approved by AW.

- B. Where sandy or granular materials are encountered, a cement slurry or polymer supplement shall be considered for added strength and stability of the bore and over ream hole.
- C. No chemicals or polymer surfactant shall be used in the drilling fluid without written consent of AW, and after a determination is made that the chemicals to be added are not harmful or corrosive to the facility and are environmentally safe. Clay must be totally inert and contain no risk to the environment.
- D. Provide Owner, Engineer and have on site at all times the Material Safety Data Sheets (MSDS) for all drilling compounds and chemicals.

**.04 TRACER WIRE**

- A. When HDPE pipe is used, tracer or location wire shall be a direct burial #12 AWG Solid (.0808" diameter), steel core hard drawn extra high strength horizontal directional drill tracer wire, 1150# average tensile break load, 45 mil. High molecular weight-high density blue polyethylene jacket complying with ASTM D1248, 30 volt rating. The wire shall be contiguous except at test stations, valve boxes, and where splicing is required. All splices shall be encased with a 3M-Gel Pack model No. 054007-09053. Wire insulation shall be highly resistant to alkalis, acid and other destructive agents found in soil. Location Wire shall be from Copperhead Industries, LLC, part number 1230B-HS or approved equal



- B. Tracer wire shall be installed simultaneously with pullback of the HDPE pipe. Wire shall either be wrapped around the pipe or taped to the pipe at 10 foot minimum intervals before installation.

## **PART 3 EXECUTION**

### **.01 SITE DISTURBANCE AND SOIL EROSION**

- A. Sediment barriers shall be constructed as shown on the Drawings or where directed by AW. All soil erosion and sediment control work shall be done in accordance with the Standards for Soil Erosion and Sediment Control for the location where the work is performed. Contractor shall maintain sediment barriers until the project is deemed complete.
- B. The Contractor shall be responsible for the preservation of all existing trees, plants, and other vegetation that are to remain within or adjacent to the construction site and shall also be responsible for protecting existing concrete curb, fence, utilities, and other structures that are located within or adjacent to the construction site.
- C. The Contractor assumes all liability for environmental damage and cleanup due to inadvertent discharges of slurry or other causes. Slurry materials shall be selected based on the soil conditions encountered to minimize the risk of mud returns.

### **.02 PERSONNEL REQUIREMENTS:**

- A. Provide a competent and experienced supervisor representing the Drilling Contractor who must be present at all times during actual operations. A responsible representative, who is thoroughly familiar with the equipment and type work to be performed, must be in direct charge and control of the operation at all times. In all cases the supervisor must be continually present at the job site during the actual Directional Pilot Hole, over reaming and pullback operations.
- B. Have a sufficient number of competent workers on the job at all times to insure the Directional Bore is made in a timely and satisfactory manner. Adequate personnel for carrying out all phases of the actual Directional Bore operation must be on the job site at the beginning of work.
- C. If HDPE is specified for the carrier pipe, HDPE pipe thermal butt fusion welding is to be completed by a welder certified by the manufacturer of the pipe or pipe welding equipment, in accordance with the Plastic Pipe



Institute "Handbook of Polyethylene Pipe," Polyethylene Joining Procedures, and 49 CFR 192, Subpart F, latest edition.

- D. AW and Owner must be notified 48 hours in advance of starting each phase of the work. The Directional Bore shall not begin until AW is present at the job site and agrees that proper preparations for the operation have been made. AW's approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the Contract. It shall be the responsibility of Owner to provide inspection personnel at such times as appropriate without causing undue hardship by reason of delay to the Contractor.
- E. If the Contractor fails to begin the Directional Bore at the agreed time, AW will establish the next mutually convenient time to begin. To avoid undue hardship of either party, reasonable and mutual cooperation should be exercised where starting times are concerned. If one party fails to meet the agreed schedule, the other party is expected to consider a delayed start if the installation cannot be completed during daylight hours.

### **.03 ALIGNMENT AND GRADE**

- A. Determine and physically locate the depth, location, and size of all existing underground facilities in the vicinity of the proposed crossings and provide AW with a comprehensive report of these facilities before starting any construction. The Contractor shall be held completely and solely responsible for any damages incurred. The kinds, locations and sizes of the existing underground utilities which may be shown on the Contract Drawings are intended only as a guide to the Contractor and are not guaranteed to be even approximately correct. Notify AWs of all existing utilities along the route and in the vicinity of the crossing prior to the construction to include all test borings and excavations.
- B. If utilities of unknown depth or other obstructions require grade or alignment deviations from the Plans, the grade and/or alignment may be adjusted with Engineer's approval. All adjustments shall permit gradual bends of the pipe to the original alignment beyond the directional bore section. At unusual site conditions, the Contractor may request a review of site conditions by AW for additional adjustment, and such determination shall be final. An adjustment in alignment, position, or elevation approved by Engineer shall not be cause for an adjustment of costs.
- C. Pipe entry and exit points are to be allowed no more than five (5) feet of deviation from the staked centerline. The entry point may be moved up to



twenty-five (25) feet further from the original entry point only with Engineer's approval. Exit point lengths greater than twenty-five (25) feet from the original point require Engineer's approval. Entry and exit points normally will not be allowed closer to the banks of a waterway being crossed. Any installation that deviates from the plan may be rejected and any rejected installation shall be reconstructed at the Contractor's expense.

- D. The vertical profile as shown on the drawings is the minimum depth to which the pipeline shall be installed. Contractor may, at his option and with the permission of AW, elect to install the pipe at a greater depth than shown on the drawings, at no additional cost to AW.

#### **.04 INSTALLATION:**

- A. The Contractor shall be responsible for providing a Maintenance of Traffic Plan to AW and local traffic law enforcement agency for review. The Maintenance of Traffic Plan shall show the location of all barricades, signs, devices and alternate routes for local traffic and pedestrian safety. Erection of the appropriate safety and warning devices in accordance with the USDOT "Manual of Uniform Traffic Control Devices" (MUTCD) shall be completed prior to beginning work and maintained until all construction is completed and the site restored.
- B. Specifically note in the Maintenance of Traffic Plan street intersections that are to remain open as required during the pipe pull-back operation, or traffic detours implemented. Install a temporary sleeve across the street intersections through which the pipe can be pulled or to construct a temporary bridge for the pipe over the intersections as required. No additional payment will be made for temporary structures required in order to permit access through street intersections or the implementation of traffic detours.
- C. The cost of restoring pavement, curb, sidewalk, driveways, lawns, storm drains, etc., and other landscaped facilities shall be borne by the Contractor unless otherwise noted.
- D. The following is a general outline of steps for the Directional Bore operation:
  - 1. Clear the right-of-way and temporary work space as shown on the drawings. Contractor to install and maintain all soil erosion and sediment control devices, until project completion with approved permanent site stabilization.



2. Lay out the pipe crossing alignment using a qualified land survey team to confirm accurate horizontal distances, either physically measured or shot by Electric Distance Measurement. Entry and exit points shall be located and marked with survey hubs or markers. Payment for survey mark-out shall be included in the price bid under horizontal directional drilling.
3. Haul, string, and assemble restrained pipe. Joint air test the section prior to installation and hydrostatically test the assembled pipeline section, unless otherwise approved by Engineer. If sufficient linear footage of lay down area for the pipe string is not available, the finished pipeline may be assembled in no more than two sections, with each section joint air tested separately and hydrostatically tested when fully assembled as one piece. The CONTRACTOR will be responsible for ensuring that the drill rig has adequate pullback capacity to overcome the increased frictional resistance resulting from the stoppage of pipe pullback to perform the final weld or fusion of pipe sections. Provide adequate site security and shall be responsible for the integrity of the pipe until after the pullback, final test of the pipeline, and acceptance of the work by AW.

All assembled pipe sections shall be securely plugged at the end of each work day. The pipe interior is to be protected at all times against dirt, dust, drilling mud, pipe cuttings, debris, animal access, and other sources of contamination.

4. Provide adequate support rollers for the pipeline during pullback of the pipe string into the pre-drilled hole. The rollers and cradles shall be of a type that will prevent damage to the pipe and will be of sufficient number, as recommended by pipe manufacturer, to prevent over stressing due to sag bends during the pullback procedure. The pipe shall be supported at all times, including pullback, to maintain a free stress arc which limits pipe bending and internal hoop stresses to within manufacturer's limits.

Pipe which is not properly protected and supported and shows indications of excessive stressing, gouges, cuts, abrasions or other damage which may affect the operational performance intended for the pipe, as recommended by pipe manufacturer, shall be removed from the site and replaced at no additional cost as directed by AW.

5. Mobilize the drilling equipment, erect the rig, drill a pilot hole, enlarge the hole as necessary to a minimum diameter of 1.5 times



the nominal diameter of the pipe, and pullback the prefabricated pipe string under the crossing.

Prior to beginning the Pilot Hole over reaming, furnish to AW an as-built plan and profile of the actual crossing to confirm the installation is in compliance with the Contract Documents. Pilot hole alignment shall be accepted by AW in writing prior to reaming and pipe installation.

The Contractor shall be responsible for selecting the reaming process to be utilized, whether forward and/or back reaming will be undertaken, and the number of reaming passes to be made.

6. Supply portable mud tanks or construct temporary mud pits to contain excess drill fluids during construction and slurry material displaced by the pipe during installation. Mud pits are to be protected at all times against unauthorized access and be stabilized at all times against surface water runoff and containment berm failure. Pump, haul and dispose of any drill cuttings and excess drill fluids to a receiving site permitted to accept the spoils, all in a manner consistent with the local and state regulations at no additional cost to AW.
7. Pull back the bore pipe in one continuous section and contractor using a swivel to minimize the rotation of the product pipe during pullback. Swivel shall utilize lubricated internal bearings which are fully protected from external contamination and over lubrication. Demonstrate the swivel operation prior to pullback to AW prior to the operation.
8. Use potable water and disinfect all piping and hoses used for water addition to the carrier pipe to counter the pipe flotation during pullback.
9. During pullback, maintain records for submission to AW indicating job, date, time, constant pipe footage progress, mud flow rates, pulling forces required and torque readings. Document the pull head location for each length of drill stem pipe for as build records.
10. Unless not permitted by the right of way owner, inject a low strength cement slurry into the bore hole for approximately 50 feet at each end of the drilled pipeline. Where cement slurry cannot be used, provide restraint at either end of the pipeline outside the bore to hold the pipe in place. The type of restraint shall be submitted to AW in advance of the work and must be approved by AW prior to the start of





construction.

11. AW shall have access at all times to any measuring or gauging devices used for the horizontal drill as well as any drilling logs maintained by the Contractor.
12. In the event that the Contractor must abandon the drill hole before completion of the crossing, the Contractor will seal the borehole with neat cement grout starting at the low point or end of the drill hole and redrill the crossing at no extra cost to AW.

#### **.05 PRESSURE TESTING AND LEAKAGE**

- A. Prior to pullback, perform an allowable leakage test on the full length of pipe after all sections have been welded or fused in accordance with ANSI/AWWA C600, latest revision and as described in Specification Section 15030. A hydrostatic pressure test shall also be performed on the installed pipe in accordance with ANSI/AWWA C600, latest revision and as described in Specification Section 15030.

#### **.06 CONNECTION TO ADJOINING PIPE**

- A. Install flange connections from the directionally drilled pipe to adjacent pipe installed by open cut with support by backfill material as per Specification Section 02320. Flange bolts shall be carefully tightened in increments, with a final torque value not exceeding the manufacturer's recommendations. Tightening torque increments shall not exceed 15 foot pounds.
- B. Polyethylene and flange gasket will undergo some compression set. Therefore, the flange bolts shall be retightened one hour after the initial assembly, and a second time at least four hours after the second tightening.

#### **.07 DISINFECTION**

- A. The carrier pipe shall be disinfected as described in Specification Section 15020 or as otherwise approved in advance by AW.
- B. The carrier pipe can be filled with potable water, pressure tested and disinfected prior to insertion. Provide AW with full work plan to employ this alternative.



**.08 AS-BUILT RECORDS:**

- A. The MGS pullback data shall be recorded every pilot hole drill stem length during the actual crossing operation. The Contractor shall furnish "as-built" plan and profile drawings, on the same horizontal and vertical control datum shown on the contract documents, based on these recordings showing the actual location horizontally and vertically of the installation, and all utility facilities found during the installation.

**END OF SECTION 02458**

## **SECTION 02540**

### **EROSION AND SEDIMENTATION CONTROL**

#### **PART 1 GENERAL**

##### **.01 SCOPE OF WORK**

Work to be performed under this Specification Section refers to temporary and permanent vegetation covers, mulching, and baling at the construction site and all areas disturbed during construction, including borrow areas. In addition to the requirements of these Specifications, comply with all local Conservation District laws, rules and regulations and all other Federal, State, County and local requirements for erosion and sedimentation control.

##### **.02 STANDARDS**

Comply with the highest erosion and sedimentation control standards, whether Conservation District, Federal, State or local. If in doubt as to the applicable standard, notify the Engineer and comply with the Engineer's directions concerning the prevailing jurisdiction.

#### **PART 2: PRODUCTS**

##### **.01 MATERIALS - GENERAL**

All materials such as seeds, mulch, silt fencing and bales shall conform to the Specifications of the local Conservation District and all other applicable Federal, State, County and local requirements.

#### **PART 3: EXECUTION**

##### **.01 GENERAL**

- A. Submit plan to comply with regulators and AW for approval using established best practices. Construct silt fences, diversion ditches with catch basins and drains as shown on the Plans prior to any other construction activity.
- B. Drain the settled water from the catch basins to the natural local drains. Clean the catch basins regularly. After final grading, seed and mulch the area per Specification Sections 1.02 and 2.01.

- C. Permanent vegetation cover, mulching, and baling shall be in accordance with the Conservation District specifications and all other applicable Federal, State and local requirements.

**END OF SECTION 02540**

**SECTION 02614****CONCRETE CURBS, DRIVES, AND SIDEWALKS****PART 1 GENERAL****1.01 SCOPE**

The work under this section shall include the installation of all concrete curbs, sidewalks, and drives. Installation will include new installations as required on the drawings, and replacement of all curbs, drives and sidewalks damaged or removed incidental to construction. Adhere to most stringent requirements between local regulations and this specification concerning concrete installations for work performed on property owned by others (the municipality or private owners other than American Water).

**PART 2: PRODUCTS****2.01 CONCRETE**

- A. All concrete shall conform to the following: ASTM C-150 Type I Portland cement, Class A - 3,000 psi; design mix, with a 4-inch  $\pm$  air-entrained slump ready mixed in accordance with ASTM C-94.
- B. Aggregate shall conform to ASTM C-33, which is clean, hard, durable, screened, crushed stone or gravel. The aggregate shall contain no cheat.

**2.02 REINFORCEMENT**

As needed to meet or exceed existing conditions or as specified in these contract documents.

**2.03 CURING COMPOUND**

Curing compound shall conform to the specifications of AASHTO M148, Type II, clear, and shall consist of a practically colorless impervious liquid which will thoroughly seal the surface of the concrete and will not impart a slippery surface thereto. The quality and the quantity to be used shall be approved by AW. The use of any material which would impart a slippery

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surface to the concrete or alter its natural color will not be permitted. The colorless, impervious compound shall contain not less than twenty-five percent (25%) solids. Admixtures applied to concrete with reinforcing steel require review and approval by AW before use.

## 2.04 PROTECTION

Immediately upon finishing the concrete, the concrete shall be completely covered with plastic, or alternate approved by AW. Canvas or wetted straw will not be allowed as alternate coverings for curing.

## PART 3: EXECUTION

### 3.01 CURBS

- A. All base for the installation shall be thoroughly compacted to support curb installation. Expansion joints should be provided at a minimum of every 12 feet.
- B. All new curb installations shall be as shown on the drawings, and as detailed on the detail sheets.
- C. All replacement curbs shall be of the same type and thickness as the curb and gutter which it abuts. The grade of the restored curb and gutter shall conform with the grade of the existing adjacent curb and gutter, and installed to insure there is no ponding of water.

### 3.02 DRIVEWAYS

- A. All base for the installation shall be thoroughly compacted and leveled to support the new and replacement installations without settlement. Expansion joints should be provided at a minimum of every 30 feet.
- B. All new driveways shall be installed as shown on the plans, and as detailed on the detail sheets.
- C. All permanent restoration of driveways shall conform to the construction as originally placed and to the original lines and grades, unless directed otherwise by AW.

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1. No patching of concrete driveway areas will be allowed between joints or dummy joints.
2. All joints shall be saw cut.
3. In no case shall the thickness of the driveway be less than four inches, with 6x6x6/6 woven wire mesh.

### 3.03 SIDEWALKS

- A. All base for the installation of sidewalks shall be thoroughly compacted and leveled to support the new and replacement installations without settlement. Expansion joints should be provided at a minimum of every 30 feet.
- B. All new sidewalks shall be installed as shown on the plans and as detailed on the detail sheets.
  1. Sidewalks shall have a minimum thickness of four inches, with 6x6x10/10 wire mesh.
  2. All sidewalks shall slope 1/4 inch per foot across the width of the walk toward the street.
  3. The finish shall be a broom finish at right angles to the walkway.
  4. Dummy expansion grooves shall be marked on the sidewalk at five foot intervals. The grooves shall be 1/2 inch deep by 3/8 inch in width.
  5. Sawed grooves will not be permitted.
- C. All permanent restoration of sidewalks shall conform to the manner of construction as originally constructed and placed (brick, block or stone).
  1. When concrete sidewalks are replaced, the replacements shall match the existing line and grades, and width.
  2. All replacement work shall meet the requirements of new

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sidewalk construction. No patching will be allowed between joints or dummy joints.

3. If a curing compound is employed, it shall be applied per the manufacturer's direction and at a recommended rate of application. If unknown, it shall be applied at 1 gallon (3.79 liters) per 200 square feet (18.58 square meters) for each coat. Surfaces damaged by construction operations during curing shall be resprayed at the same rate.

### 3.04 PAVED SIDE DITCH

- A. All base for the installation shall be thoroughly compacted and leveled to support the new and replacement installations without settlement.
- B. All new side ditch shall be installed as shown on the plans, and as detailed on the detail sheets.
- C. All permanent restoration of side ditch areas shall conform to the construction as originally placed and to the original lines and grades in accordance with the current appropriate state transportation department guidelines.
  1. No patching of concrete side ditches will be allowed between joints or dummy joints.
  2. All joints shall be saw cut.

### 3.05 PROTECTION

All concrete work shall be protected by barricades, lights, etc. to protect the concrete until set-up.

**END OF SECTION 02614**

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**SECTION 02820****LAWN RESTORATION****PART 1 GENERAL****.01 DESCRIPTION**

Restore and replace shrubbery, fencing, or other disturbed surfaces or structures to conditions equal to that before the work began and to the satisfaction of AW.

**PART 2 PRODUCTS****.01 TOPSOIL**

Topsoil shall not contain more than 40 percent clay in that portion passing a No. 10 sieve. Topsoil shall contain between 5 percent and 20 percent organic matter as determined by loss on ignition of samples oven-dried to constant weight at 212 degrees Fahrenheit.

**.02 FERTILIZER**

Fertilizer shall be lawn or turf grade 12-12-12.

**.03 SEED AND SOD****A. Lawn Areas**

Seed areas where lawns are or have been regularly maintained, whether residential, commercial or office areas, with the following mixture or a mixture as required by the Soil Conservation District or other governing authority. (Percentages are by weight.)

*20 percent Annual Ryegrass (Lolium multiflorum).  
Remainder to be specified depending on time of year,  
regulatory requirements and location.*

Where sod is required it shall be green, freshly cut, and of good quality with grass free from all noxious weeds. It shall contain all the dense root system of the grass and shall not be less than 1-1/2 inches thick.

**B. All other Areas**



Seed all other areas with the following mixture:

*50 percent Perennial Ryegrass (Lolium perenne).  
Remainder to be specified depending on time of year,  
regulatory requirements and location.*

**.04 MULCH**

Mulch shall be straw reasonably free of weed seed and foreign materials which may affect plant growth. Other materials may be used if approved by AW.

**.05 ASPHALT EMULSION**

Emulsion shall be non-toxic to plants and shall conform to AASHTO M140 or AASHTO M208.

**PART 3 EXECUTION**

**.01 PREPARATION OF SEED BED**

**A. Topsoil Areas**

Removed, store, and use suitable topsoil available from the excavated material to backfill the top 4 inches of the excavation. Remove and dispose of all imported granular fill, grass, weeds, roots, sticks, stones, and other debris 1-inch or greater in diameter. Bring the topsoil to the finished grade by raking.

**B. Non-Topsoil Areas**

When there is insufficient topsoil available from the site excavated materials, furnish 4 inches of topsoil to be used as a seed bed in lawn areas as described in Part 2.03, Paragraph A of this Specification Section or clearly marked as lawn areas on the plans.

The trench backfill may be used as a seed bed, where approved by AW or in areas clearly marked on plans that are not considered lawn areas. After the backfill has been given a reasonable time to settle, grade it off to the finished grade and harrow to a depth of 3 inches. Remove and dispose of all grass, weeds, roots, sticks, stones and other debris 1 inch or greater in diameter. Carefully bring the topsoil to the finished grade by raking.

## .02 FERTILIZING

Apply fertilizer uniformly to all areas to be seeded at the rate of 1 pound per 100 square feet in topsoil and 2 pounds per 100 square feet in non-topsoil. Disk, harrowed, or raked the fertilizer thoroughly into the soil to a depth of not less than 2 inches. Immediately before sowing the seed, rework the surface until it is a fine, pulverized, smooth seed bed varying not more than 1 inch in 10 feet.

## .03 SEEDING

Seed immediately after preparation and fertilization of the seed bed. Mix the seed thoroughly and sow it evenly over the prepared areas at the rate of 3 pounds per 1,000 square feet. Sow the seed dry or hydraulically. After sowing, rake or drag the area to cover the seed to a depth of approximately 1/4 inch. Sod all areas with slopes greater than 10%.

## .04 SODDING

Sod all areas as noted in the drawings. As a minimum, sod shall be fibrous, well rooted approved grass type. The grass shall be cut to a height of less than three (3) inches. Edges of sod shall be cleanly cut, either by hand or machine, to a uniform thickness of not less than one and one-half (1-½) inches, to a uniform width of not less than sixteen (16) inches, and in strips of not less than three (3) feet in length. Sod shall be free from all primary noxious weeds.

Lay sod with tight staggered joints. On slopes, start placement at the foot of the incline. Use wood pegs driven flush to hold sod in place on slopes 4:1 or greater. Use two wood pegs per strip of sod. Roll the sod lightly after placement. Fill any open joints with topsoil and/or sod.

## .05 MULCHING

Place mulching material evenly over all seeded areas within 48 hours of seeding. Place mulch at the rate of approximately 2 tons per acre, when seeding is performed in recognized growing season and at the approximate rate of 3 tons per acre when seeding is performed in a recognized non-growing season if applicable.

## .06 EMULSION

Keep mulching materials in place with asphalt emulsion applied at a minimum rate of 60 gallons per ton of mulch or by other methods

approved by the Engineer. When mulch is displaced, immediately repair any damage to the topsoil and fertilizer, re-seed, and re-mulch per the requirements of this Specification Section.

**.07 MAINTENANCE**

Carefully maintain, tend, and water all seeded and sodded areas necessary to secure a good turf. Fill, grade, and reseed or re-sod all areas that have settled. Maintain the condition of the sodded areas for a period sufficient for the grass to root into the topsoil. Maintain the condition of the seeded areas in accordance with the requirements of this Specification Section for a period of one year from the date of final completion.

**END OF SECTION 02820**

## SECTION 03300

### CAST-IN-PLACE CONCRETE

#### PART 1 GENERAL

##### .01 SCOPE OF WORK

Provide concrete for thrust blocking, manhole bases, pipe encasement, curbs, sidewalks and pavement in accordance with this Specification Section.

#### PART 2 PRODUCTS

##### .01 MATERIALS

A. Portland Cement shall be Type I or Type III and conform to "Specification for Portland Cement" ASTM C150.

B. Air-Entraining Agent from approved manufacturer shall be added in accordance with manufacturer's directions to the normal Portland cement to entrain 4½ percent air  $\pm$  1 percent with all other ingredients and strength as specified. Air-entraining admixtures shall conform to "Specifications for Air-Entraining Admixtures for Concrete" ASTM C260.

C. Concrete Aggregates shall conform to "Specifications for Concrete Aggregates" ASTM C33. Coarse aggregates shall be a maximum of 1½ inches in size in footings and plain concrete. Pea gravel shall be used for sections 3 inches or less in thickness.

D. Water used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalis, organic materials, or other deleterious substances. In effect, the water used shall be potable water.

E. Reinforcing Bars shall be billet steel grade (60,000 psi minimum yield) conforming to the requirements of ASTM A615, Grade 60. Reinforcing bars shall be new stock, free from rust, scale, or other coatings that tend to destroy or reduce bonding.

F. Welded Wire Mesh shall conform to "Specifications for Welded Steel Wire Fabric for Concrete Reinforcements" ASTM A185.

G. Premolded Expansion Joint Material shall be provided where shown on the Drawings or directed by the Engineer. This non-extruding compressible joint material shall conform to the requirements of "Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction", ASTM D1751.

## .02 CONCRETE MIXES

Ready-mixed concrete shall conform to "Specifications for Ready-Mixed Concrete", ASTM C94.

- A. All concrete mixes shall produce a dense durable concrete. The minimum 28 day compressive strength of the concrete shall be:
- B. 3,000 psi - thrust blocking, sidewalks, curbs and pipe encasement.  
4,000 psi - manhole bases and road pavement
- C. Water/cement ratio for the concrete shall not exceed a maximum as shown in Table 4.4 of the ACI Standard 318 latest edition, Building Code Requirements For Reinforced Concrete, when strength data from field experience or trial mixtures are not available. A workable concrete with minimum slump of 3 inches and a maximum slump of 5 inches shall be produced without exceeding the water/ cement ratio.

## PART 3 EXECUTION

### .01 FORMWORK

- A. Build all forms mortar tight and of sufficient rigidity to prevent distortion due to the pressure of the concrete and other loads incidental to the construction operations. Construct and maintain forms so as to prevent warping and the opening of joints.
- B. The forms shall be substantial and unyielding. Design the forms so that the finished concrete conforms to the proper dimensions and contours. Design the forms to take into account the effect of the vibration of concrete during placement.

### .02 PLACING REINFORCING STEEL

- A. Place all steel reinforcement accurately in the positions shown on the plans. Secure the steel reinforcements firmly in place during the placing and setting of concrete. When placed in the work, it shall be free from dirt, detrimental rust, loose scale, paint, oil or other foreign

material. When spacing between crossing tie bars is one foot more, tie all bars at all intersections. When spacing is less than one foot in each direction tie alternate intersections of bars.

- B. Maintain distances from the forms by means of stays, blocks, ties, hangers or other approved supports. Continuous high chairs will not be permitted. Furnish all reinforcement in full lengths as indicated on the plans. Splicing of bars will not be permitted without the approval of the Engineer, except where shown on the plans. Stagger splices as far apart as possible. Unless otherwise shown on the plans, bars shall be lapped 36 diameters to make the splice.
- C. Lap welded wire mesh at least 1½ meshes plus end extension of wires but not less than twelve (12) inches in structural slabs. Lap welded wire mesh at least ½ mesh plus end extension of wires but not less than six (6) inches in slabs on the ground.

### .03 CONVEYING AND PLACING CONCRETE

- A. Convey concrete from the mixer to the forms as rapidly as practical by approved methods which will prevent segregation and loss of ingredients.
- B. Clean formwork of dirt and construction debris, drain water, and remove snow and ice. After the forms have been inspected, deposit the concrete in approximately horizontal layers to avoid flowing along the forms. Place all concrete in the dry free from standing water. Deposit all concrete continuously or in layers of a thickness such that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams and planes of weakness within the sections. Place the concrete to create a monolithic structure the component parts of which are securely bonded together. Compact the concrete during placement by suitable means. Work the concrete around the reinforcement and embedded fixtures and into corners and angles of forms, taking care to avoid overworking which may result in segregation.
- C. Do not drop concrete into forms from a height greater than 5 feet. Use a spout to deposit concrete from a greater height; or, provide openings in the forms limit the height of drop. Obtain the approval of AW before using any other method of placing concrete from a height greater than 5 feet.

- D. Direct concrete through chutes to prevent it from striking reinforcement or sides of the form above the level of placement. Avoid segregation and coating of the surfaces with paste which may dry before concrete reaches its level.
- E. Submit a concrete mix design to AW for approval prior to placing any concrete by pumping.

### 3.04 THRUST BLOCKING

- A. See the thrust blocking details. Notify AW whenever field conditions are noted which are more restrictive than the thrust block design data included on details.
- B. Construct blocking against the vertical face of undisturbed earth or sheeting left in place. Prevent the concrete from enclosing more than half the circumference of the pipe unless it is a straddle block. Keep the concrete away from joints or bolts in the piping.
- C. If thrust blocks are employed, place thrust blocking for hydrants to allow the hydrant to drain.

### 3.05 PLACING CONCRETE IN COLD WEATHER

- A. Follow the provisions of ACI 306, ACI 308 and Paragraph 3.8 when the ambient temperature is less than 40°F at time of placement or expected to be less than 40°F during the curing period.
- B. Control concrete setting time with the use of accelerating admixtures as required to facilitate placing and finishing operations. Do not use calcium chloride in excess of 2% by weight in the concrete free of steel reinforcement. Where steel reinforcement is employed and concrete with calcium chloride is permitted, contractor must use galvanized or coated steel satisfactory to the Engineer.
- C. Exposed subgrade, formwork and reinforcing shall be warmer than 33°F prior to placement of concrete.
- D. The temperature of the concrete during placing shall be between 55°F and 75°F. Maintain the temperature of the concrete between 55°F and 75°F for a minimum of 5 days by providing insulating blankets, heated enclosures, or other methods of thermal protection. Provide a means of maintaining atmospheric moisture when dry heat is used. Provide proper curing for a minimum of days or as approved by the Engineer.

- E. In case of low air temperatures (below 40°F), submit a plan to comply with this section. The Engineer may, at their discretion, raise the minimum limiting temperatures for water, aggregates and mixed concrete when temperatures drop below 40°F.
- F. Protect all earth supported concrete from damage due to frost heave.

**END OF SECTION 03300**





## SECTION 03450

### PRECAST CONCRETE MANHOLES

#### PART 1 GENERAL

##### .01 SECTION INCLUDES

- A. Precast concrete manholes for sanitary sewers, storm sewers, and water lines.
- B. Precast concrete sanitary sewer manholes with PVC liner where corrosion resistant manholes are specifically indicated in Drawings.
- C. Pile-supported concrete foundation used for unstable subgrade treatment for manhole base.

##### .02 SUBMITTALS

- A. Conform to requirements of Section 01300 - Submittals.
- B. Submit manufacturer's data and details of following items for approval:
  - 1. Shop drawings of manhole sections, base units and construction details, including reinforcement, jointing methods, materials and dimensions.
  - 2. Summary of criteria used in manhole design including, as minimum, material properties, loadings, load combinations, and dimensions assumed. Include certification from manufacturer that precast manhole design is in full accordance with ASTM C 478 and design criteria as established in Paragraph 2.01E of this Specification.
  - 3. Frames, grates, rings, and covers
  - 4. Materials to be used in fabricating drop connections
  - 5. Materials to be used for pipe connections at manhole walls
  - 6. Materials to be used for stubs and stub plugs, if required
  - 7. Materials and procedures for corrosion-resistant liner and coatings, if required.
  - 8. Plugs to be used for sanitary sewer hydrostatic testing
  - 9. Manufacturer's data for pre-mix (bag) concrete, if used for channel inverts and benches



## PART 2 PRODUCTS

### .01 PRECAST CONCRETE MANHOLES

- A. Provide manhole sections, base sections, and related components conforming to ASTM C 478. Provide base riser section with integral floors, unless shown otherwise. Provide adjustment rings which are standard components of manufacturer of manhole sections. Mark date of manufacture and name or trademark of manufacturer on inside of barrel.
- B. Construct barrels for precast manholes from standard reinforced concrete manhole sections of diameter indicated on Drawings. Use various lengths of manhole sections in combination to provide correct height with fewest joints. Design wall sections for depth and loading conditions in Paragraph 2.01 E, with minimum thickness of 5 inches. Base section shall have minimum thickness of 12 inches under invert.
- C. Provide tops to support AASHTO HS-20 vehicle loading, and receive cast iron frame covers, as indicated on Drawings.
- D. Where manholes larger than 48-inch diameter are indicated on Drawings, provide precast base sections with flat slab top precast sections used to transition to 48-inch diameter manhole access riser sections. Transition can be concentric or eccentric unless otherwise shown on Drawings. Locate transition to provide minimum of 7-foot head clearance from base to underside of transition unless otherwise approved by AW Project Manager.
- E. Design Loading Criteria: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed, by manufacturer, to requirements of ASTM C 478 for depth as shown on Drawings and to resist following loads.
  - 1. AASHTO HS-20 vehicle loading applied to manhole cover and transmitted down to transition and base slabs
  - 2. Unit soil weight of 120 pcf located above portions of manhole, including base slab projections
  - 3. Lateral soil pressure based on saturated soil conditions producing an at-rest equivalent fluid pressure of 100 pcf
  - 4. Internal liquid pressure based on unit weight of 63 pcf
  - 5. Dead load of manhole sections fully supported by transition and base slabs
- F. Design: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed according to requirements of ASTM C 478 and following:
  - 1. Design additional reinforcing steel to transfer stresses at openings. Area of steel to be no less than shown on Drawings.



2. Wall loading conditions:
  - a. Saturated soil pressure acting on empty manhole
  - b. Manhole filled with liquid to a halfway depth as measured from invert to cover, with no balancing external soil pressure
3. Minimum clear distance between two wall penetrations shall be 12 inches or half diameter of smaller penetration, whichever is greater
- G. Provide joints between sections with o-ring gaskets conforming to ASTM C 443.
- H. When base is cast monolithic with portion of vertical section, extend reinforcing in vertical section into base.
- I. Precast Concrete Base: Suitable cutouts or holes to receive pipe and connections. Lowest edge of holes or cutouts: For water line manhole, no less than 6 inches above inside surface of floor of base.

#### .02 CONCRETE

- A. Conform to requirements of Section 03330- Cast-In-Place Concrete.
- B. Channel Inverts: Use 5 sack premix (bag) concrete or Class A concrete for inverts not integrally formed with manhole base, with minimum compressive strength of 4000 psi.
- C. Cement Stabilized Sand Foundation: Provide cement stabilized sand foundation under base section in lieu of foundation slab, as shown on Drawings.
- D. Concrete Foundation: Provide Class A concrete with minimum compressive strength of 4000 psi for concrete foundation slab under manhole base section where indicated on Drawings.

#### .03 REINFORCING STEEL

- A. Conform to requirements of Section 03330 – Cast-In-Place Concrete.

#### .04 FRAMES AND COVERS

- A. Use castings for frames, grates, rings and covers conforming to ASTM A 48, Class 35B. Provide locking covers if indicated on Drawings.
- B. Use clean castings capable of withstanding application of AASHTO M306- 40,000 pound proof loading without detrimental permanent deformation.
- C. Fabricate castings to conform to shapes, dimensions, and with wording or logos shown on Drawings. Standard dimensions for manhole covers are 32 inches in diameter.



- D. Use clean castings, free from blowholes and other surface imperfections. Use clean and symmetrical cast holes in covers, free of plugs.
- E. Where indicated on Drawings, provide watertight manhole frames and covers with minimum of four bolts and gasket designed to seal cover to frame. Supply approved watertight manhole covers and frames.
- F. Where shown on Drawing, provide manhole frames and covers with 48 inch diameter clear - opening, with inner cover for 22 inch diameter clear opening. Provide approved inner cover with pattern shown on Drawings.

#### .05 DROP CONNECTIONS AND STUBS

- A. Provide drop connections and stubs conforming to same pipe material requirements used in main pipe, unless otherwise indicated on Drawings.

#### .06 PIPE CONNECTIONS TO MANHOLE

- A. Sanitary Sewers.
  - 1. Provide resilient connectors conforming to requirements of ASTM C 923. Use the following materials for metallic mechanical devices as defined in ASTM C 923:
    - 1. External clamps: Type 304 stainless steel
      - a. Internal, expandable clamps on standard manholes: Type 304 stainless steel, 11 gauge minimum.
      - b. Internal, expandable clamps on corrosion-resistant manholes:
        - 1) Type 316 stainless steel, 11 gauge minimum
        - 2) Type 304 stainless steel, 11 gauge minimum, coated with minimum 16 mil fusion bonded epoxy conforming to AWWA C 213
  - 2. Where rigid joints between pipe and cast-in-place manhole base are specified or shown on Drawings, provide polyethylene-isoprene water-stop meeting physical property requirements of ASTM C 923, such as Press-Seal WS Series, or approved equal.
- B. Storm Sewer Connections:
  - 1. Combined sewers are strictly prohibited for all AW facilities..
- C. Water Lines
  - 1. Where smooth exterior pipes, i.e., steel, ductile iron, or PVC pipes are connected to manhole base or barrel, seal space between pipe and manhole wall with assembly consisting of rubber gasket or links mechanically compressed to form a watertight barrier. Assemblies: Press-Wedge, Res-Seal, Thunderline Link-Seal, or approved equal. See Drawings for placement of assembly in manhole sections.



2. When connecting concrete or cement mortar coated steel pipes, or as option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of a stainless steel power sleeve, stainless steel take-up clamp and a rubber gasket. Take-up clamp: Minimum of 9/16 inch wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.

#### .07 SEALANT MATERIALS

- A. Submit products in accordance with Section 01300 - Submittals.
- B. Provide sealing materials between precast concrete adjustment ring and manhole cover frame, Adeka Ultraseal P201, or approved equal.
- C. Provide approved external sealing material from Canusa Wrapid Seal manhole encapsulation system, or approved equal.
- D. Provide Butyl Sealant: Provide Press-Seal EZ Stick, or equal, for HDPE rings.

#### .08 CORROSION RESISTANT MANHOLE MATERIALS

- A. Where corrosion-resistant manholes or PVC-lined manholes are indicated on Drawings, provide a PVC liner for precast cylindrical manhole section, base sections, and cone sections. Only plastic liners manufactured with integral locking ribs spaced at approximately 2-1/2 inches on center over entire liner is acceptable. Liners relying on mechanically fastened batten strips as primary means of anchorage are unacceptable. PVC liner shall be manufactured by Ameron Protective Linings Division; Poly-tee, Inc; or approved equal.

#### .09 BACKFILL MATERIALS

- A. Conform to requirements of Section 02317 - Excavation and Backfill for Utilities.

#### .010 NON-SHRINK GROUT

- A. Provide prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based grout requiring only addition of water.
- B. Meet requirements of ASTM C 1107 and have minimum 28-day compressive strength of 7000 psi.

#### .011 VENT PIPES

- A. Provide external vent pipes for manholes where indicated on Drawings.



- B. Buried Vent Pipes: Provide 3 inch or 4 inch PVC DWV pipe conforming to ASTM D 2665. Alternatively, provide FRP pipe as specified for vent outlet assembly.
- C. Vent Outlet Assembly: Provide vent outlet assembly as shown on Drawings, constructed of following specified materials:
  - 1. FRP Pipe: Provide filament wound FRP conforming to ASTM D 2996 or centrifugally cast FRP conforming to ASTM D 2997. Seal cut ends in accordance with manufacturer's recommendations.
  - 2. Joints and Fittings: Provide epoxy bodied fittings and join pipe to fittings with epoxy adhesive
  - 3. Flanges: Provide socket-flange fittings for epoxy adhesive bonding to pipe ends where shown on Drawings. Meet bolt pattern and dimensions for ASME B 16.1, 125-pound flanges. Flange bolts shall be Type 304 stainless steel or hot-dip zinc coated, conforming to ASTM A 307, Class A or B.
  - 4. Coating: Provide approved 2-component, aliphatic polyurethane coating using primer or tie coat recommended by manufacturer. Provide two or more coats to yield dry film thickness of at least 3 mils. Color shall be selected by Project Manager from manufacturer's standard colors.

#### .012 PROHIBITED MATERIALS

- A. Do not use brick masonry for construction of sanitary sewer manholes, including adjustment of manholes to grade. Use only specified materials listed above.

#### .013 MANHOLE LADDER FOR WATERLINE MANHOLES

- A. Manhole Ladder: Fiberglass with 300-lb rating at appropriate length; conform to requirements of Occupational Safety and Health Standards (OSHA), U.S. Department of Labor except where shown on Drawings
  - 1. Use components, including rungs, made of fiberglass, fabricated with nylon or aluminum rivets and/or epoxy. Apply non-skid coating to ladder rungs. Mount ladder using manufacturer's recommended hardware.
  - 2. Provide ladder as manufactured by Saf-Rail or approved equal. Locate ladder as shown on Drawings.
  - 3. Fiberglass: Premium type polyester resin, reinforced with fiberglass; constructed to provide complete wetting of glass by resin; resistant to rot, fungi, bacterial growth and adverse effects of acids, alkalis and residential and industrial waste; yellow in color.
- B. Provide approved petroleum-based tape encapsulating bolts in access manhole.



## PART3 EXECUTION

### .01 EXAMINATION

- A. Verify that lines and grades are correct.
- B. Determine if subgrade, when scarified and recompact, can be compacted to 95 percent of maximum Standard Proctor Density according to ASTM D 698 prior to placement of foundation material and base section. When proper density is not reached, moisture condition subgrade until that density is reached or treat as unstable subgrade.
- C. Do not build manholes in ditches, swales, or drainage paths unless approved by Project Manager.

### .02 PLACEMENT

- A. Install precast manholes to conform to locations and dimensions shown on Drawings.
- B. Place sanitary and storm manholes at points of change in alignment, grade, size, pipe intersections, and end of sewer unless otherwise shown on Drawings.

### .03 MANHOLE BASE SECTIONS AND FOUNDATIONS

- A. Place precast base on 12 inch thick (minimum) foundation of crushed stone wrapped in filter fabric, cement stabilized sand, or concrete foundation slab. Compact cement-sand in accordance with requirements of Section 02321 - Cement Stabilized Sand.
- B. Unstable Subgrade Treatment: When unstable subgrade is encountered, notify Project Manager for examination of subgrade to determine if subgrade has heaved upwards after being excavated. When heaving has not occurred, over-excavate subgrade to allow for 24inch-thick layer of crushed stone wrapped in filter fabric as foundation material under manhole base. When there is evidence of heaving, provide pile-supported concrete foundation, as detailed on Drawings, under manhole base.

### .04 PRECAST MANHOLE SECTIONS

- A. Install sections, joints, and gaskets in accordance with manufacturer's printed recommendations.
- B. Install precast adjustment rings above tops of cones or flat-top sections as required to adjust finished elevation and to support manhole frame.
- C. Seal any lifting holes with non-shrink grout.





- D. Where PVC liners are required, seal joints between sections in accordance with manufacturer's recommendations.
- E. Place at least two precast concrete grade rings with thickness of 12 inches or less, under casting.

#### .05 PIPE CONNECTIONS AT MANHOLES

- A. Install approved resilient connectors at each pipe entering and exiting manholes in accordance with manufacturer's instructions.
  - 1. Where smooth exterior pipes, i.e. steel, ductile iron or PVC pipes are connected to manhole base or barrel, space between pipe and manhole wall shall be sealed with an assembly consisting of rubber gaskets or links mechanically compressed to form watertight barrier. Assemblies: "Press-Wedge," "Res-Seal," "Thunderline Link-Seals," or approved equal. See Drawings for placement of assembly in manhole sections.
  - 2. When connecting concrete or cement mortar coated steel pipes, or as an option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of stainless steel power sleeve, stainless steel take-up clamp and rubber gasket. Take-up clamp: Minimum of 9/16 inch wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.
- B. Grout storm sewer connections to manhole unless otherwise shown on Drawings. Grout pipe penetration in place on both inside and outside of manhole.
- C. Ensure no concrete, cement stabilized sand, fill, or other rigid material is allowed to enter space between pipe and edge of wall opening at and around resilient connector on either interior or exterior of manhole. If necessary, fill space with compressible material to ensure full flexibility provided by resilient connector.
- D. Where new manhole is constructed on existing sewer, rigid joint pipe may be used. Install waterstop gasket around existing pipe at center of cast-in-place wall. Join ends of split waterstop material at pipe springline using an adhesive recommended and supplied by waterstop manufacturer.
- E. Test connection for watertight seal before backfilling.

#### .06 INVERTS FOR SANITARY SEWERS

- A. Construct invert channels to provide smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:
  - 1. Slope of invert bench: 1 inch per foot minimum; 1-1/2 inches per foot maximum





2. Depth of bench to invert:
  - a. Pipes smaller than 15 inches: one-half of largest pipe diameter
  - b. Pipes 15 to 24 inches: three-fourths of largest pipe diameter
  - c. Pipes larger than 24 inches: equal to largest pipe diameter
3. Invert slope through manhole: 0.10 foot drop across manhole with smooth transition of invert through manhole, unless otherwise indicated on Drawings.
- B. Form invert channels with concrete if not integral with manhole base section. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

#### .07 DROP CONNECTIONS FOR SANITARY SEWERS

- A. Backfill drop assembly with crushed stone wrapped in filter fabric, cement stabilized sand, or Class A concrete to form solid mass. Extend cement stabilized sand or concrete encasement minimum of 4 inches outside bells.
- B. Install drop connection when sewer line enters manhole higher than 24 inches above invert of manhole.

#### .08 STUBS FOR FUTURE CONNECTIONS

- A. In manholes, where future connections are indicated on Drawings, install resilient connectors and pipe stubs with approved watertight plugs.

#### .09 MANHOLE FRAME AND ADJUSTMENT RINGS

- A. Combine precast concrete or HDPE adjustment rings so elevation of installed casting cover matches pavement surface. Seal between concrete adjustment ring and precast top section with non-shrink grout; do not use mortar between adjustment rings. Apply latex-based bonding agent to precast concrete surfaces joined with non-shrink grout. Set cast iron frame on adjustment ring in bed of approved sealant material. Install sealant bed consisting of two beads of sealant, each bead having minimum dimensions of 1/2-inch and 1/2-inch wide.
- B. Wrap manhole frame and adjustment rings with external sealing material, minimum 3 inches beyond joint between ring and frame and adjustment rings and precast section.
- C. For manholes in unpaved areas, set top of frame minimum of 6 inches above existing ground line unless otherwise indicated on Drawings. In unpaved areas, encase manhole frame in mortar or non-shrink grout placed flush with face of manhole ring and top edge of frame. Provide rounded corner around perimeter.

**.010 BACKFILL**

- A. Place and compact backfill materials in area of excavation surrounding manholes in accordance with requirements of Section 02317 - Excavation and Backfill for Utilities.
- B. Where rigid joints are used for connecting existing sewers to manhole, backfill existing sewer up to springline of pipe with Class B concrete or flowable fill.
- C. In unpaved areas, provide positive drainage away from manhole frame to natural grade. Provide restoration of disturbed areas in accordance with Section 02820 – Lawn Restoration.

**.011 DOGHOUSE MANHOLE**

- A. Existing sewer pipe to remain until satisfactory completion of manhole testing.
- B. Crown of existing pipe shall be flush with concrete shelf that is formed within the manhole.
- C. Doghouse manholes shall be constructed per the drawings.

**.012 FIELD QUALITY CONTROL**

- D. Conduct testing of sanitary sewer manholes in accordance with requirements of Sections 15250 (Acceptance Testing for Sanitary Sewers) and 15255 (Manhole Vacuum Testing).

**.013 PROTECTION**

- A. Protect manholes from damage until work has been accepted. Repair damage to manholes at no additional cost to AW.

**END OF SECTION 03450**

**SECTION 03451****MANHOLE REHABILITATION****PART 1: GENERAL**

This section includes cleaning, plugging, sealing, lining, and general repairs of defective manholes. Different repair methods and procedures are listed in this section. Refer to "Table 1- Manhole Rehabilitation Schedule" located at the end of this section for a list of manholes to be repaired and method used for each manhole.

**1.01. SCOPE OF WORK**

- A. The Contractor shall be responsible for furnishing all labor, supervision, materials, and equipment required to complete all manhole rehabilitation work, testing, and surface restoration in accordance with this Specification.
- B. All sections of this Specification are mutually complimentary and the overall intent is that the Contractor shall provide for everything in his portion of the work required to make a complete and operable job in every respect unless specifically noted otherwise.
- C. It is the intent of this Specification to ensure that the work, as completed, shall meet all applicable codes, ordinances, rules and regulations of every authority having jurisdiction in the area where the construction is located. Failure of the contractor to point out items that do not meet such requirements does not relieve the Contractor or his Subcontractors of the responsibility of meeting them.
- D. All supplies shall be stored and maintained by the Contractor in accordance with manufacturer's recommendations. Materials shall not be exposed to adverse conditions prior to the work. All materials shall be kept in a secured area and away from general public access. The Contractor shall review and maintain all Material Safety Data Sheets (MSDS), product labeling, and technical literature at the project site.

**1.02. QUALIFICATIONS**

01300-1

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum three years documented experience and approved by manufacturer.

### **1.03. PRE-INSTALLATION MEETING**

- A. Installer shall convene at the site with Owner minimum one week prior to commencing work of this section.

## **PART 2: MANHOLE REHABILITATION METHODS AND PROCEDURES**

### **2.01 GENERAL**

- A. All work shall be in strict accordance with the specifications and recommendations including application of all products as required and in accordance with manufacturers directions.
- B. When freezing temperatures are expected in the area, the Contractor shall take measures to keep applied materials warm and provide the required heat in the manhole before repair work is started and the 24 hour period following application.
- C. The invert shall be covered during construction operations to prevent loose materials from collecting in the invert.
- D. Bypassing and/or blocking of the flow in the manholes shall be done only with prior approval of the Owner.
- E. The Owner shall supply water necessary for the project to the contractor at no cost, from locations indicated by the Owner prior to the start of the *project*.
- F. It shall be the contractor's responsibility to provide traffic control as required by the particular location and/or jurisdiction.
- G. Use approved equipment designed and manufactured by the material supplier specifically for the application of all materials in sanitary system manholes.

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- H. Do not apply materials to frozen surfaces or if freezing is expected within substrate within 24 hours after application.
- I. Examine surfaces to receive manhole rehabilitation. Notify AW Project Manager in writing if surfaces are not acceptable for rehabilitation.

## .02 MANHOLE CLEANING AND PREPARATION

- A. The floor and interior walls of the manhole shall be thoroughly cleaned and made free of all foreign materials including dirt, grit, roots, grease, sludge and all debris or material that may be attached to the wall or bottom of the manhole.

- B. High pressure water blasting with a minimum of 3500psi shall be used to clean all foreign material within the manhole.

When grease and oil are present within the manhole, an approved detergent or muriatic acid may be used integrally with the high pressure cleaning water if conditions dictate.

- D. All materials resulting from the cleaning of the manhole shall be removed prior to applying specified linings.
- E. All loose or defective brick, grout, ledges, steps and protruding ledges shall be removed to provide an even surface prior to application of cement based coating.

## 2.03 PATCHING

### 2.03.01 Materials

- A. Patching material shall be quick setting fiber reinforced calcium aluminate corrosion resistant cementitious material, mixed and applied according to manufacturer's recommendations and having the following minimum requirements:

Compressive Strength ASTM C109	1400 psi, 6 hours
Bond ASTM C321	145 psi, 28 days

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Cement	Calcium Aluminate
Applied Density	105 lbs +1- 5 lbs pcf
Shrinkage ASTM C596	0 percent at 90 percent relative humidity

Patching material shall be Strong-Seal® QSR, or approved equal

### 2.03.02 Execution

- A. Patching of manhole walls or sewer structures if necessary, shall be required in areas where large voids exist, such as mortar missing between bricks, around step frames, pipes and spalled concrete. All loose, cracked and corroded material shall be removed from the area to be patched, exposing a sound substrate. A fast setting polymer mortar shall be applied to dampened surfaces. These products shall be allowed to cure before applying linings.
- B. When leaks are not readily identifiable upon completion of cleaning operation, use blower to dry manhole interior for positive identification of leaks and weep areas.
- C. Drill hole at each identifiable leakage point from inside manhole extending through sidewall of manhole. Insert metal rod through hole to determine if exterior void space exists. Fill exterior void spaces with grout mix. Pump into void space until refusal is recorded by rise in pressure on pump pressure gauge. Ensure hole through manhole wall is kept open and free of patching material. Plug hole and allow one hour for material to set.
- D. Upon completion of grouting, pump manhole sealant until refusal at minimum pressure of 3.0 psig through probe type injection equipment. Deposit sealant coating from interior surface of set grout through drilled hole to inside surface of manhole.
- E. Upon setting of sealant coatings remove excess material protruding into inside of manhole.
- F. Patching/plugging manhole defects as necessary shall be performed to provide a smooth surface for application of the lining material.



## 2.04 SEAL ACTIVE LEAKS

Stop active leaks with patching material or infiltration control materials applied according to manufacturer's instructions. Install weep holes as required to localize infiltration during application of patching material or infiltration control material. Plug weep holes after application with infiltration control material before applying liner material.

### 2.04.01 Materials

#### 2.04.01.01 Infiltration Control

- A. Infiltration control material shall be a rapid setting cementitious product specifically formulated for leak control to stop minor water infiltration and making repairs in concrete and brick structures, mixed and applied according to manufacturer's recommendations and having the following minimum requirements:

Compressive Strength ASTM C109	400-600 psi, 1 hour 1800- 2400 psi, 24 hours
Expansion ASTM C827	0.10 percent
Sulfate Resistance ASTM C267	No weight loss after 15cycles, 200ppm
Freeze/Thaw ASTM C666	100 cycles "Method A"
Pull Out Strength ASTM C234	14,000 lbs
Placement time	Less than 1 minute

Infiltration control material shall be Strong-Seal® or Strong-Plug, or approved equal.

#### 2.04.01.02 Severe Infiltration Control

Severe infiltration shall be identified in field by Owner.

- A. Grouting material shall be cementitious grout for stopping very active infiltration and filling voids when mixed and applied according to manufacturer's recommendations. The grout shall be volume stable with a minimum 28-day compressive strength of 250 psi. Grout shall be StrongSeal® Grout 250 or Grout 1000, or approved equal.

#### 2.04.02 Execution

- A. The work consists of hand applying a dry quick-setting cementitious mix designed to instantly stop running water or seepage in all types of concrete and masonry structures. The applicator shall apply material in accordance with manufacturer's recommendations and following specifications.
- B. The area to be repaired must be clean and free of all debris per the guidelines set forth in section Manhole Cleaning and Preparation section.
- C. Once cleaned, prepare crack or hole by chipping out loose material to a minimum depth and width of  $\frac{3}{4}$  inch.
- D. With gloved hand, place a generous amount of the dry quick-setting cementitious material to the active leak, with a smooth fast motion, maintaining external pressure for 30 seconds, repeat until leak is stopped.
- E. Proper application should not require any special mixing of product or special curing requirements after application.

#### 2.05 REPAIR INVERT, BENCH AND TROUGH

##### 2.05.01 Materials

- A. Materials used for bench and trough repairs shall be a rapid setting, high early strength, non-shrink material conforming to section 03315 and patching material specified herein.

##### 2.05.01 Execution

- A. Construct invert channels to provide smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:
  - 1. Slope of invert bench: 1 inch per foot minimum; 1-1/2 inches per foot maximum
  - 2. Depth of bench to invert:
    - a. Pipes smaller than 15 inches: one-half of largest pipe diameter
    - b. Pipes 15 to 24 inches: three-fourths of largest pipe diameter
    - c. Pipes larger than 24 inches: equal to largest pipe diameter



3. Invert slope through manhole: 0.10 foot drop across manhole with smooth transition of invert through manhole, unless otherwise indicated on Drawings.

- B. Form invert channels with concrete if not integral with manhole base section.
- C. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.
- D. The work consists of hand mixing and applying a rapid setting, high early strength, non-shrink patching material to fill all large voids and repair inverts prior to lining of the manhole. For invert repairs, flow must be temporarily restricted by inflatable or mechanical plugs prior to cleaning.
- E. The area to be repaired must be cleaned and free of all debris per the guidelines set forth in section 2.02 Manhole Cleaning and Preparation.
- F. Mix water shall be clean potable water and require no additives or admixtures for use with cementitious patching materials.
- G. Cementitious material shall be mixed in a mortar tub or 5-gallon pail with water per manufacturer's specifications. Material shall be mixed in small quantities, to avoid setting prior to placement in voids or inverts.
- H. Once mixed to proper consistency, the materials shall be applied to the invert or void areas by hand or trowel. In invert applications, care should be taken to not apply excessive material in the channel, which could restrict flow. Once applied, materials shall be smoothed either by hand or trowel in order to facilitate flow.
- I. Flows in inverts can be reestablished within 30 minutes of material placement.

## 2.06 REPLACE MANHOLE FRAME AND COVER

### 2.06.01 Materials

#### 2.06.01.01 Castings

A. Use castings for frames, grates, rings and covers conforming to ASTM A 48, Class 35B.

B. Use clean castings capable of withstanding application of AASHTO M306-40,000 pound proof loading without detrimental permanent deformation.

#### 2.06.01.02 Bearing Surfaces

A. Machine bearing surfaces between covers or grates and their respective frames so that even bearing is provided for position in which casting may be seated in frame.

#### 2.06.01.03 Frames and Covers

A. Provide watertight manhole frames and covers with minimum of four bolts and gasket designed to seal cover to frame. Supply approved watertight manhole covers and frames.

B. Provide manhole frames and covers with clear opening that matches existing, with inner cover for 22 inch diameter clear opening.

#### 2.06.01.04 Finish

A. Uncoated cast iron.

#### 2.06.02 Execution

A. Remove and dispose existing frame and cover.

B. Install castings according to approved shop drawings, instructions in related specifications, and applicable directions from manufacturer's printed materials.

C. Set castings accurately at required locations to proper alignment and elevation. Keep castings plumb, level, true, and free of rack. Measure location accurately from established lines and grades. Brace or anchor frames temporarily in form work until permanently set.

D. Fabricate ring grates in accordance with standards. Set in mortar in mouth of pipe bell.

E. Install adjustment rings in existing frames with clean bearing surfaces that are free from rocking.

F. Restore surface to pre-existing

condition. 2.07 ADJUST MANHOLE TO  
GRADE

2.07.01 Materials

- A. Provide precast concrete manhole sections and adjustment rings conforming to requirements of Section 02082 - Precast Concrete Manholes, and Section 02084 - Frames, Grates, Rings, and Covers.

2.07.02 Execution

- A. Examine existing structure, frame and cover for damage or defects affecting adjustment to grade. Report damage or defects to Owner.
- B. Establish grade with related items with existing grade and finished grade or paving, and relate to established bench mark or reference line.
- C. Rebuild adjustment portion of manhole or inlet by adding or removing Adjustments. Follow procedures for the type of structure being adjusted detailed in the following Sections:  
  
  - Section 02082 - Precast Concrete Manholes
  - Section 02083 - Fiberglass Manholes
  - Section 02316 - Excavation and Backfill for Structures
- D. Salvage and reuse cast-iron frame and cover or grate.
- E. Protect or block off manhole or inlet bottom using wood forms shaped to fit so that no debris or soil falls to bottom during adjustment.
- F. Verify that manholes and inlets are free of visible leaks as result of reconstruction. Repair leaks in manner subject to Owner's approval.
- G. Backfill area of excavation surrounding each adjusted manhole, inlet, and valve box and compact according to requirements of
- H. Grade ground surface to drain away from each manhole and valve box. Place earth fill around manholes to level of upper rim of manhole frame. Place earth fill around valve box concrete slab.
- I. In unpaved areas, grade surface at uniform slope of 1 to 5 from manhole frame to natural grade. Provide minimum of 4 inches of topsoil conforming to requirements of Section 02911 - Topsoil.

J. Provide seeding in accordance with Section 02921 --- Seeding.

## 2.08 INFLOW DISHES

### 2.08.01 Materials

A. Plastic inflow dishes shall be made of an ultra high density, polyethylene copolymer, meeting the requirements of ASTM D1248, Class A, Category 5, Type 3 (Marlex I-IXM50100 or equal). Dishes shall have a minimum impact brittleness temperature of minus (-) 180 degrees F, Environmental Stress Crack Rating (ESCR) of 800, Flexural Modulus of 175,000, uniform thickness of 1/8" or greater, web type lift strap with stainless steel rivet and %" washer, vent hole or valve and a closed cell neoprene gasket under the weight bearing surface of the rim. Dishes shall be "NoFlow InFlow", or pre-approved equal, and shall have a 5-year minimum warranty against cracking.

### 2.08.02 Execution

A. A dish shall be inserted to prevent water from entering through the manhole cover. Wire brush steel casting rim and set dish in place. Required measurements for proper fit shall be the responsibility of the contractor.

## 2.09 MANHOLE FRAME SEAL

### 2.09.01 Materials

A. Manhole frame sealing includes the sealing of the frame adjustment area with a corrosion resistant aromatic flexible urethane resin coating. The sealing system shall be Flex-Seal Utility Sealant as manufactured by Sealing Systems Inc. or approved equal. It shall be designed to prevent leakage of water into the manhole through this area. The sealing system shall remain flexible and allow vertical movement of the frame up to 0.5 inches.

B. Primer- Flexible Aromatic Urethane Resin Liner Primer minimum requirements:

Hardness ASTM D2240	85
Elongation ASTM D412	400 percent
Tensile Strength ASTM D412	3200 psi
Adhesive Strength ASTM D903	400 lb/in
Tear Resistance ASTM D1004	210 lb/in

C. Final Coat: Flexible Aromatic Urethane Resin Liner Final Coat  
minimum requirements:

Hardness ASTM D2240 75  
Elongation ASTM D412 800 percent  
Tensile Strength ASTM D412 1150 psi  
Adhesive Strength ASTM D903 175 lb Fin  
Tear Resistance ASTM D1004 155 lb Fin

2.09.02 Execution

- A. Contact surfaces shall be clean, smooth and circular, and free of excessive voids. Remove loose and protruding mortar and brick. Prepare surfaces of the ring adjustment area to include the lower 3 inches of the frame and the top 8 inches of the cone section according to manufacturer's instructions. A total of 12 vertical inches applied at 120 mil thickness. Greater depths may be covered at the engineer's direction depending on conditions of the manhole.
- B. If the masonry surface is rough, irregular, or contains excessive voids and will not provide an effective seal, apply a bed of patching mortar. Allow mortar to cure prior to installing the flexible manhole sealant system per manufacturer's recommendations. The minimum cure time will be 14 days before application of sealant.
- C. Correct active internal leaks prior to installing the flexible manhole sealant system per manufacturer's recommendations.
- D. Prepare internal surface by sand blasting casting section to white metal with sand. After sandblasting, check the entire area to remove any loose sand, debris, laitances, dust, dirt, oil, grease or chemical combination. At engineer's discretion, sand is to be captured and not allowed to enter the manhole.
- E. Use of a blower may be required to completely dry the surface as recommended by the manufacturer. Surface of manhole must be completely dry prior to primer application.
- F. Mix and apply the adhesive primer to the clean and dry surface according to manufacturers recommendations. Cover the ring adjustment area, the lower 3 inches of the casting frame and the top 8 inches of the cone section. Allow for proper drying of the adhesive primer, then apply sealant by brush, as evenly as possible over the entire area and allow to cure per manufacturer's recommendations. Minimum thickness of sealant is 120 mils.

2.10 CHIMNEY SEALS

2.10.01 Materials

- A. Chimney Seals shall be designed to provide a watertight, interior flexible seal between the manhole cover frame and manhole cone section. The seal shall consist of a rubber seal, stainless steel expansion bands for compressing the seal against the manhole surfaces and preformed extension(s) and band. The frame seal shall be certified capable of repeated vertical movement of not less than 2 inches and/or repeated horizontal movement of not less than 2 inch after installation and throughout its 25-year design life.
- B. Rubber sleeves shall be extruded from a high grade rubber compound meeting the applicable requirements of ASTM C923. Sleeves shall be double or triple pleated with a minimum unexpanded vertical height of 8 inches, a minimum thickness of 3/16 inch, capable of expanding not less than 2 inches vertically when installed. They shall have integrally formed top and bottom expansion band recess's and multiple sealing fins. Any splices shall be factory vulcanized and shall be able to withstand a 180degree bend with no visible separation at splices.
- C. Expansion Bands shall be 6 gauge thickness, 1 3/4 inches wide and made of stainless steel meeting the requirements of ASTM A240, Type 304. Bands shall have an expansion mechanism capable of developing the pressure necessary to provide a watertight seal, a minimum adjustment range of not less than two (2) diameter inches and a positive locking mechanism. Bands must be removable with minimum effort and reusable.
- D. Chimney seals shall be provided by Cretex Specialty Products or pre-approved equal. Measurements shall be the responsibility of the Contractor.

#### 2.10.02 Execution

- A. Chimney seals and extensions shall be installed in strict accordance with the manufacturer's specifications and recommendations, including use of butyl caulk on the lower portion of the seal when installed in brick manholes. The installation of the chimney seal and extension shall include the preparation of the wall surfaces in the chimney area and the adjustment of the frame as required by the manufacturer's specifications and recommendations. Chimney seals and extensions shall be manufactured by Cretex Specialty Products, or pre-approved equal, and installed in accordance with the manufacturer's directions. Measurements shall be the responsibility of the contractor.
- B. Precast Manholes, shall be sealed from the bottom 2 inches of the steel casting to the top 2 inches of the precast manhole cone and include all grade rings.
- C. Brick manholes, manholes, shall be sealed from the bottom 2 inches of

the steel casting to the second level of brick courses of the manhole chimney.

## **2.11 MANHOLE STEP REPAIR**

- A. Manhole step repair shall include replacing missing steps and others requiring replacement as directed by the engineer. The contractor shall remove the existing steps where required, drill the necessary holes and perform all other work to install and anchor the replacement steps. The metal portion of any replaced steps shall be removed completely.
- B. Manhole Ladder: Fiberglass with 300-lb rating at appropriate length; conform to requirements of Occupational Safety and Health Standards (OSHA), U.S. Department of Labor.
1. Use components, including rungs, made of fiberglass, fabricated with nylon or aluminum rivets and/or epoxy. Apply non-skid coating to ladder rungs. Mount ladder using manufacturer's recommended hardware. Rungs shall be located at 12-inch centers.
  2. Provide ladder as manufactured by Saf-Rail or approved equal.
  3. Fiberglass: Premium type polyester resin, reinforced with fiberglass; constructed to provide complete wetting of glass by resin; resistant to rot, fungi, bacterial growth and adverse effects of acids, alkalis and residential and industrial waste; yellow in color.
  4. Provide approved petroleum-based tape encapsulating bolts in access manhole.

## **2.12 PRE-FORMED MANHOLE UNIT**

### **2.12.01 Materials**

- A. Flowtite Fiberglass Rehabilitation Manhole, as provided by Containment Solutions, Inc, or pre-approved equal.

### **2.12.02 Execution**

- A. When indicated in the schedule, the manhole shall be lined with a preformed manhole unit. Installation procedures shall follow manufacturers recommendations.

## **2.13 EPOXY LINING SYSTEM**

### 2.13.01 Materials

- A. The epoxy manhole liner shall be chemical resistant (below a pH of 2.0), VOC compliant, moisture tolerant, 100% solids, two (2) component epoxy system with the following properties:

Flexural Strength [ASTM D-790]:	9,000 psi
Compressive Strength [ASTM D-695]:	8,200 psi
Tensile Strength [ASTM D-638]:	6,300 psi
Adhesion:	Concrete Substrate Failure
Abrasion Resistance:	95 mg
Tabor Coefficient, ASTM D-4060	

- B. The epoxy manhole liner shall be "CITADEL SLS-30" as manufactured by CITADEL Technologies Inc. or approved equal.

### 2.13.02 Execution

- A. When indicated in the schedule, the manhole shall be lined interior surface with a two component, 100% solids epoxy coating system which provides a durable, high strength, monolithic lining, at an average thickness of 70 mils with a minimum thickness of 65 mils. Provide mixing and application equipment designed for mixing and spraying epoxy coating as recommended by the manufacturer. The two (2)-part epoxy liner shall be mixed in accordance with the manufacturer recommendations.
- B. The epoxy liner shall be applied in accordance with the manufacturer's recommendations. The surface prior to application may be damp but shall not have noticeable free running water. Materials shall be spray applied per manufacturer's recommendations to an average thickness of 70 mils with a minimum thickness of 65 mils. The final application shall have a minimum of four (4) hours cure time before being subjected to active flow. The epoxy liner shall be applied from the invert (completely cover the Bench and Invert) to 3" onto the manhole frame.
- C. During the application, a wet film gauge shall be used regularly to insure that minimum thickness is being maintained. After the epoxy liner has set (hard to touch), all visible pinholes shall be repaired. Repairs shall be made by lightly abrading the surface and brushing the lining material over the area. All blisters and evidence of uneven coverage shall be repaired according to the manufacturer's recommendations. After the product has set to touch, the surface shall be inspected for pinholes and thin spots using a Holiday Detector capable of 16,000 volts. All pinholes and areas less than one square foot that test to be thin may be retouched by hand, but any areas larger than one square foot must be re-sprayed.



## 2.14 CEMENTITIOUS LINING SYSTEM

### 2.14.01 Materials

- A. All cementitious lining materials shall be specifically designed for the rehabilitation of manholes. Liner materials shall be cement based, nylon fiber reinforced, shrinkage compensated, and enhanced with chemical admixtures and monocrystalline quartz (Granusil) aggregates. Liner materials shall be mixed with water per manufacturer's written specifications and applied using equipment specifically designed for either low-pressure spray or centrifugal spin casting application of cement mortars. All cement liner materials must be capable of a placement thickness of 2" to 4" in a one pass monolithic application.
- B. For low to mild hydrogen sulfide environments (pH > 3.0), cementitious lining materials shall be manufactured from Type II Portland cement, and enhanced with silica fume. Approved material shall be Quadex QM-I s Restore as manufactured by Quadex, Inc., Little Rock, Arkansas or "preapproved" equal. Approved material shall exhibit the following 28-day minimum physical properties.

Compressive Strength (ASTM C 109) >10,000 psi  
Flexural Strength (ASTM C293) > 1,400 psi  
Bond Strength (ASTM C321) Brick failed before bond  
Permeability (AASHTO T-277) Not to exceed 350 coulombs  
Freeze-Thaw (ASTM C666) No damage in minimum 300 cycles  
Material Wet Density Minimum 142 +/-5 PCF

### 2.14.02 Execution

- A. The work consists of spray applying and/or centrifugally spin casting a cementitious based liner to the inside of the existing manhole. The necessary equipment and application methods to apply the cementitious based liner materials shall be only as approved by the material manufacturer.
- B. Material shall be mixed with water in accordance with manufacturer's specifications. Once mixed to proper consistency, the materials shall be pumped via a rotor-stator style progressive cavity pump through a material plaster hose for delivery to the appropriate and / or selected application device.

#### 2.14.02.01 Spray application of the cementitious material.

- A. Material hose shall be coupled to a low-velocity spray application nozzle. Pumping of the material shall commence and the mortar shall be atomized by the introduction of air at the nozzle, creating a low-

velocity spray pattern for material application.

- B. Spraying shall be performed by starting at the manhole invert and progressing up the wall to the corbel and chimney areas.
- C. Material shall be applied to a specified uniform minimum thickness no less than  $\frac{1}{2}$  inch. Material shall be applied to the bench area in such a manner as to provide for proper drainage without ponding.

#### 2.14.02.02 Centrifugal spin casting application of the cementitious material.

- A. Material hose shall be coupled to a high speed rotating applicator device. The rotating casting applicator shall then be positioned within the center of the manhole at either the top of the manhole chimney or the lowest point elevation corresponding to the junction of the manhole bench and walls.
- B. The high speed rotating applicator shall then be initialized, and pumping of the material shall commence. As the mortar begins to be centrifugally cast evenly around the interior of the manhole, the rotating applicator head shall be raised and lowered at a controlled retrieval speed conducive to providing a uniform material thickness on the manhole walls.
- C. Controlled multiple passes are then made until the specified minimum finished thickness is attained. If the procedure is interrupted for any reason, simply arrest the retrieval of the applicator head until flows are recommenced.
- D. Material thickness may be verified at any point with a depth gauge and shall be no less than a uniform  $\frac{1}{2}$ -inch. If additional material is required at any level, the rotating applicator head shall be placed at that level and application shall recommence until that area is thickened.
- E. Material shall be applied only when manhole is in a damp state, with no visible water dripping or running over the manhole walls.
- F. The low-velocity spray nozzle and the centrifugal spin casting head may be used in conjunction to facilitate uniform application of the mortar material to irregularities in the contour of the manhole walls and bench areas.
- G. Troweling of materials shall begin immediately following the spray application. Initial troweling shall be in an upward motion, to compress the material into voids and solidify manhole wall. Precautions should be taken not to overtrowel. All trowled surfaces shall then be given a light brush finish. Brush shall be kept wet with potable water.

- H. It is important that the manhole cover is replaced immediately after troweling and brushing are complete to avoid moisture loss in the material due to sunlight and wind. Lining material may be subjected to active flows or surcharges after an initial set time of 9 to 12 hours. Ideal curing is achieved at a temperature of 72 degrees Fahrenheit and 80% humidity. Curing may be affected when ambient conditions within the structure fall below the ideal temperature and/or humidity. Liners may be subjected to additional cleaning after a period of 24 hours at the above stated conditions.
- I. Material shall not be applied during freezing weather conditions. Material shall not be placed when the ambient temperature is 37 degrees Fahrenheit and falling or when the temperature is anticipated to fall below 32 degrees Fahrenheit during 24 hours.

## **2.15 VACUUM TESTING**

- A. Vacuum testing is required on all designated manholes as required by the AW Military Group Project Manager in schedule. Vacuum tests shall be performed no sooner than 28 days after rehabilitation and repairs on a manhole are completed. A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valve closed, the time shall be measured to drop to 9 inches. The manhole shall pass if the time is greater than 60 seconds for a 48" diameter manhole, 75 seconds for a 60" diameter manhole and 90 seconds for a 72" manhole. Procedures established in ASTM C 1244 shall apply to this section.

## **PART 3: WARRANTY**

The Contractor shall warrant his work product for a period of one year from date of project completion. The Contractor shall repair all the defects, discovered during the warranty period, to the satisfaction of the Owner.



## SECTION 03500

### VALVE BOXES AND METER VAULTS

#### PART 1 GENERAL

##### .01 SECTION INCLUDES

- A. Valve boxes for water and wastewater service.
- B. Meter boxes for water service.
- C. Meter vaults for water and wastewater service.

##### .02 SUBMITTALS

- D. Conform to requirements of Section 01300 - Submittals.
- E. Submit manufacturers' product data for following items for approval:
  - 1. Each type of valve box and lid.
  - 2. Each type of meter box and cover.
  - 3. Each type of meter vault frame and cover.
- F. Submit design calculations and shop drawings for precast vault elements, sealed by an Engineer registered in the State where the project is to be completed.
- G. Submit shop drawings for cast-in-place meter vaults for approval if proposed construction varies from Drawings.

#### PART 2 PRODUCTS

##### .01 VALVE BOXES

- A. Provide approved Type A, cast-iron/ductile-iron, slide-type, valve boxes. Design of valve box shall minimize stresses on valve imposed by loads on box lid.
- B. Cast letter 'S' into lid for valves serving wastewater force main lines, 1/2 inch in height and raised 3/32 inch. Cast letter 'W' into lid for valves serving potable water lines, 1/2 inch in height and raised 3/32 inch.
- C. Unless otherwise specified, uncoated cast iron.
- D. Riser Pipe.
  - 1. Provide 6-inch PVC, Class 150, DR 18, riser pipes in accordance with Section 15120 - Polyvinyl Chloride Pipe or;



2. 6-inch ductile-iron, thickness Class 51 riser pipes in accordance with Section 15105 - Ductile Iron Pipe and Fittings.
3. Provide single section of pipe.
- E. Concrete for valve box placement:
  1. For locations in new concrete pavement, provide strength and mix design of new pavement.
  2. For other locations, provide concrete for sidewalks conforming to requirements of Section 02614 – Curbs, Driveways, and Sidewalks.

## .02 METER BOXES

- A. Provide meter boxes for 5/8-inch through 1-inch meters of the following materials:
  1. Non-traffic bearing locations: Cast iron or concrete.
  2. Traffic bearing locations: Cast iron.
- B. Provide meter boxes for 1 1/2-inch and 2-inch meters of cast iron.
- C. Provide meter box with reading lid. Provide lids with spring-type latching devices. Lids shall contain sufficient metal that meter box can be easily located with metal detector. Cast words "WATER METER" into lid with letters of 1/2-inch height and raised 3/32 inch.
- D. Meter box dimensions shall conform to the following approximate dimensions:
  1. Length: At top -- 15 1/2 inches; at bottom 20 inches
  2. Width: At top - 12 1/2 inches; at bottom 14 3/4 inches
  3. Height: 12 inches
- E. Extensions: Meter box extensions 3 inches and 6 inches in height shall be available from manufacturer as standard item.
- F. Cast-Iron Boxes: Clean and free from sand blow-holes or other defects conforming to requirements of ASTM A 48, Class 30B. Bearing surfaces shall be machined so that covers seat evenly in frames.
  1. Boxes and lids shall have dipped, coal-tar-pitch, varnish finish.
  2. Provide lock-type meter boxes when required by Drawings. Lock mechanisms shall work with ease.
- G. Concrete Meter Boxes: Made of Class A concrete, with minimum 4000 psi compressive strength. Construct to dimensions shown on Drawings.
  1. Castings: Free from fractures, large or deep cracks, blisters or surface roughness or any other defects that may affect serviceability.
- H. Meter Boxes submittals shall be as per AW standard details.



### .03 METER VAULTS

- A. Meter vaults may be constructed of precast concrete or cast-in-place concrete unless a specific type of construction is required by Drawings.
- B. Concrete for Meter Vaults: Class A concrete, conforming to requirements of Section 03315 - Concrete for Utility Construction with minimum compressive strength of 4000 psi at 28 days.
- C. Reinforcing steel for meter vaults: Conform to requirements of Section 03300 – Cast In Place Concrete.
- D. Grates and Covers: Use castings for frames, grates, rings and covers conforming to ASTM A 48, Class 35B. Provide locking covers if indicated on Drawings.
  - 1. Use clean castings capable of withstanding application of AASHTO M306- 40,000 pound proof loading without detrimental permanent deformation.
  - 2. Fabricate castings to conform to shapes, dimensions, and with wording or logos shown on Drawings. Standard dimensions for manhole covers are 32 inches in diameter.
  - 3. Use clean castings, free from blowholes and other surface imperfections. Use clean and symmetrical cast holes in covers, free of plugs.

## PART 3 EXECUTION

### .01 EXAMINATION

- A. Obtain approval from AW Project Manager for location of meter vault.
- B. Verify lines and grade are correct.
- C. Verify compacted subgrade will support loads imposed by vaults.

### .02 VALVE BOXES

- A. Install riser pipe with suitable length for depth of cover indicated on Drawings or to accommodate actual finish grade.
  - 1. Install with bell on top of valve
  - 2. Place riser pipe in plumb, vertical position
- B. Install valve box and riser piping plumbed in a vertical position. Provide 6-inches telescoping freeboard space between riser pipe top butt end, and interior contact flange of valve box, for vertical movement damping. End of pipe resting on valve shall be notched out sufficiently to provide a snug fit around the valve bonnet and to center valve inside of pipe.
- C. Set, align, and adjust valve box so that lid is level with final grade.



- D. Paint covers of new valve boxes in fluorescent orange when installed. After completion and acceptance by AW, repaint covers black.

### .03 METER BOXES

- A. Install cast iron meter boxes in accordance with manufacturer's instructions.
- B. Construct concrete meter boxes to dimensions shown on Drawings.
- C. Adjust top of meter boxes to conform to cover elevations specified in Paragraph 3.05, Frame and Cover for Meter Vaults, below.
- D. Do not locate under paved areas unless approved by AW Project Manager. Use approved traffic type box with cast iron lid when meter must be located in paved areas.

### .04 METER VAULTS

- A. Construct concrete meter vaults to dimensions shown on Drawings. Do not cast in presence of water. Make bottom uniform. Verify lines and grades are correct and compacted subgrade will support loads imposed by vaults.
- B. Precast Meter Vaults:
  - 1. Install precast vaults in accordance with manufacturer's recommendations. Set level on a minimum 3-inch-thick bed of sand conforming to requirements of Section 02320 - Utility Backfill Materials.
  - 2. Seal lifting holes with cement-sand mortar or non-shrink grout.
- C. Meter Vault Floor Slab:
  - 1. Construct floor slabs of 6-inch-thick reinforced concrete. Slope floor 1/4 inch per foot toward sump. Make sump 12 inches in diameter, or 12 inches square, and 4 inches deep, unless other dimensions are required by Drawings. Install dowels at maximum of 18 inches, center-to-center for keying walls to floor slab.
  - 2. Precast floor slab elements may be used for precast vault construction.
- D. Cast-in-Place Meter Vault Walls:
  - 1. Key walls to floor slab and form to dimensions shown on Drawings. Minimum wall thickness shall be 4 inches.
  - 2. Cast walls monolithically. One cold joint will be allowed when vault depth exceeds 12 feet.
  - 3. Set frame for cover in concrete.



#### .05 FRAME AND COVER FOR METER VAULTS

- A. Set cast iron frame in a mortar bed and adjust elevation of cover as follows:
  - 1. In unpaved areas, set top of meter box or meter vault cover 2 to 3 inches above natural grade.
  - 2. In paved areas, set top of meter box or meter vault cover flush with adjacent concrete but no higher than 1/2-inch.

#### .06 BACKFILL

- A. Provide bank run sand in accordance with Section 02320 - Utility Backfill Materials and backfill and compact in accordance with Section 02317 - Excavation and Backfill for Utilities.
- B. In unpaved areas, slope backfill around meter boxes and vaults to provide a uniform slope 1 to 5 slope from top to natural grade.
- C. In paved areas, slope concrete down from meter box or vault to meet adjacent paved area.

#### END OF SECTION





## SECTION 02220

### WATER STORAGE TANK REMOVAL

#### PART 1 GENERAL

##### .01 SECTION INCLUDES

- A. Removal of existing water storage tanks, including disconnecting and capping of all piping, demolition of foundations, and grading and seeding of all disturbed areas.

##### .02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
  - a. Payment to furnish all labor, materials, tools, and equipment to remove and dispose of existing water storage tanks, is on unit price basis for each tank removed.
  - b. No payment will be made for work outside of a maximum 20' radius of the tank footprint, or for pavements or structures removed for Contractor's convenience, unless specifically called for in the project RFP.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

##### .03 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for demolition of existing structures.
- B. Conform to applicable codes for disposal of debris.

##### .04 SUBMITTALS

- A. Conform to requirements of Section 01300 – Submittal Procedures
- B. The following additional items shall be submitted for approval in accordance with Section 01300:
  - a. Detailed Work Plan – This plan shall be submitted within 15 days after the issuance of the Notice to Proceed and shall detail all proposed methods and sequences of operations including, but not limited to:
    - i. Tank apputenance removal.
    - ii. Removal and disposal of industrial waste.
    - iii. Dismantling procedures.



- iv. Transportation and disposal of aboveground water tanks and contents.
- v. Protection of existing structures and utilities.
- vi. Site safety plan.
- b. Documentation of acceptance of waste materials by a permitted facility capable to dispose of said waste materials. Documentation must be provided within 7 days of delivery to permitted facility.
- c. Letters of acceptance from permitted facilities and haulers. Letters shall be provided at least 14 days prior to transportation of any wastes.

#### .05 SPECIAL CONDITIONS

- A. Lead Paint Cleanup
  - a. The Contractor shall take all necessary precautions to prevent any environmental contamination of the surrounding area due to the presence of lead paint on the storage tanks to be removed.
  - b. The Contractor shall follow all federal, state, and local regulations governing the clean up and disposal of lead paint contamination.

### PART 2 PRODUCTS - NOT USED

### PART 3 EXECUTION

#### .01 REMOVAL OF WATER TANKS

- A. The procedures to remove the existing water tanks shall include, but not be limited to, the following:
  - a. Remove all electrical conduit and apputrances from the tanks prior to dismantling of the tanks.
  - b. Remove all water that may be present that is capable of being pumped out of the tanks.
  - c. Drain or flush all water from piping into the tanks.
  - d. Disconnect and cap all piping.
  - e. Remove aboveground water tanks in accordance with approved work plan.
- B. The foundations of the aboveground water tanks shall be removed down to a depth of 2' below grade. Contractor shall be responsbile for backfill of foundations abandoned in place.



## .02 DISPOSAL OF TANK CONTENTS AND DEMOLISHED MATERIALS

- A. All removed tank materials shall be loaded and trucked away from the site in such a manner as to not cause any hazard for passersby or damage to any existing facility. Any damage shall be repaired or replaced by the Contractor at no additional cost to AW.
- B. All waste material shall be disposed of in accordance with all federal, state, and local regulations.
- C. All waste materials shall become the responsibility of the Contractor and the Contractor shall be responsible for the safe and proper removal and disposal of all waste materials.
- D. Storage of waste materials at the site is not permitted.
- E. All fees and transportation costs are the responsibility of the Contractor. The Contractor shall bear full responsibility for any and all fines against the project resulting from the improper handling and disposal of the waste materials.

## .03 BACKFILL

- A. Backfill of removal areas shall be in accordance with requirements of Section 02316 - Excavation and Backfill for Structures.

## .04 RESTORATION

- A. Restoration of all disturbed areas shall be in accordance with requirements set forth in Section 02911 – Topsoil and Section 02921 – Hydro Mulch Seeding.

**END OF SECTION**

## SECTION 15000

### PIPING - GENERAL PROVISIONS

#### PART 1 GENERAL

##### .01 DRAWINGS

Dimensions shown on Contract Drawings are approximate only. Verify all piping geometry in the field and to ensure proper alignment and fit of all piping consistent with the intent of the Contract Drawings. Submit field layout drawings as required for approval.

#### PART 2 PRODUCTS

##### .01 CONTRACTOR'S RESPONSIBILITY FOR MATERIAL

- A. Examine all material carefully for defects. Do not install material which is known, or thought to be defective.
- B. AW reserves the right to inspect all material and to reject all defective material shipped to the job site or stored on the site. Failure of AW to detect damaged material shall not relieve the Contractor from his total responsibility for the completed work if it leaks or breaks after installation.
- C. Lay all defective material aside for final inspection by AW. AW will determine if corrective repairs may be made, or if the material is rejected. AW shall determine the extent of the repairs.
- D. Classify defective pipe prior to AW's inspection as follows:
  - 1. Damage to interior and/or exterior paint seal coatings.
  - 2. Damage to interior cement-mortar or epoxy lining.
  - 3. Insufficient interior cement-mortar lining or epoxy thickness .
  - 4. Excessive pitting of pipe.
  - 5. Poor quality exterior paint seal coat.
  - 6. Pipe out of round.
  - 7. Pipe barrel area damaged to a point where pipe class thickness is reduced (all pipe).
  - 8. Denting or gouges in plain end of pipe (all pipe).
  - 9. Excessive slag on pipe affecting gasket seal (DI).
  - 10. Any visible cracks, holes.
  - 11. Embedded foreign materials.

12. Non-uniform color, density and other physical properties along the length of the pipe.

- E. The Contractor shall be responsible for all material, equipment, fixtures, and devices furnished. These materials, equipment, fixtures and devices shall comply with the requirements and standards of all Federal, State, and local laws, ordinances, codes, rules, and regulations governing safety and health.
- E. The Contractor shall take full responsibility for the storage and handling of all material furnished until the material is incorporated in the completed project and accepted by AW. Contractor shall be solely responsible for the safe storage of all material furnished to or by him until incorporated in the completed project and accepted by AW.
- F. Load and unload pipe, fittings, valves, hydrants and accessories by lifting with hoists or skidding to avoid shock or damage. Do not drop these materials. Pipe handled on skidways shall not be skidded or rolled against other pipe. Handle this material in accordance with AWWA C600, C605 or C906 whichever is applicable.
- G. Drain and store fittings and valves prior to installation in such a manner as to protect them from damage due to freezing of trapped water.

.02 PETROLATUM TAPE COATING

- A. The tape coating shall be a cold applied, saturant tape made from either petrolatum or petroleum wax with a noncellulosic synthetic fiber fabric. The fabric shall be encapsulated and coated on both sides with the petrolatum or petroleum wax. The thickness of the tape shall be no less than 40 mil. The petrolatum or petroleum wax shall be at least 50% of the product by weight.
- B. The tape coating shall be supplied in sheets, pads or rolls. Pads and sheets shall be sized to fit the area that is to be covered, allowing for an overlap per AWWA Standards.

.03 RUBBERIZED-BITUMEN BASED SPRAY-ON UNDERCOATING

Subject to approval by AW, an alternative corrosion protection for exposed buried metal is an aerosol applied rubberized coating. The material shall be rapid dry and specifically designed for corrosion protection. 3M Rubberized Underseal Undercoating 08883 or any equivalent rubberized-

bitumen based spray-on undercoating may be used. Follow manufacturer's recommendations for storage and application.

## PART 3 EXECUTION

### .01 INSTALLATION - GENERAL REQUIREMENTS

- A. Lay and maintain all pipe to the required lines and depths. Install fittings, valves and hydrants in strict accordance with the Specifications at the required locations with joints centered, spigots home, and all valve and hydrant stems plumb. Do not deviate from the required alignment, depth or grade without the written consent of AW.
- B. Buried steel lugs, rods, brackets, and flanged joint nuts and bolts are not permitted unless specifically shown on the drawings or approved in writing by AW. Cover any and all buried steel lugs, rods, brackets, and flanged joint nuts and bolts with approved coating in accordance with AWWA Standard C217 prior to backfilling. Encase the same in polyethylene encased if the specifications require polyethylene encasement of the pipe.
- C. Lay all pipe to the depth specified. Measure the depth from the final surface grade to the top of the pipe barrel. The minimum pipe cover shall be as shown on the Drawings or as specified in the Specifications Special Conditions.
- D. Do not lay pipe in a wet trench, on subgrade containing frost, or when trench conditions are unsuitable for such work. If all efforts fail to obtain a stable dry trench bottom and AW determines that the trench bottom is unsuitable for such work, AW will order the kind of stabilization to be constructed, in writing. In all cases, water levels must be at least 6" below the bottom of the pipe.
- E. Thoroughly clean the pipes and fittings before they are installed. Keep these materials clean until the acceptance of the completed work. Lay pipe with the bell ends facing in the direction of laying, unless otherwise shown on the Drawings, or directed by AW. Exercise care to ensure that each length abuts the next in such a manner that no shoulder or unevenness of any kind occurs in the pipe line.
- F. Do not wedge or block the pipe during laying unless by written order of AW.

- G. Before joints are made, bed each section of pipe the full length of the barrel, at the required grade, and at the invert matching the previously laid pipe. Dig bell holes sufficiently large to permit proper joint making. Do not bring succeeding pipe into position until the preceding length is embedded and secure in place.
- H. Take up and relay pipe that is out of alignment or grade, or pipe having disturbed joints after laying. Take up, such in-place pipe sections found to be defective and replace them with new pipe. Take up, relaying, and replacement will be at the Contractor's expense.
- I. Place enough backfill over the center sections of the pipe to prevent floating. Take all other necessary precautions to prevent the floating of the pipeline by the accumulation of water in the trench, or the collapse of the pipeline from any cause. Place enough backfill over the center sections of the pipe to prevent floating. Should floating or collapse occur, restoration will be at the Contractor's expense.
- J. Bedding materials and concrete work for the pipe bedding and thrust restraint shall be as specified in Divisions 2, 3, and 15 as well as detail drawings.
- K. Prevent foreign material from entering the pipe while it is being placed. Do not place debris, tools, clothing, or other materials in the pipe during laying operations. Close all openings in the pipeline with watertight plugs when pipe laying is stopped at the close of the day's work, or for other reasons such as rest breaks or meal periods.
- L. Only cut pipe with equipment specifically designed for cutting pipe such as an abrasive wheel, a rotary wheel cutter, a guillotine pipe saw, or a milling wheel saw. Do not use chisels or hand saws. Grind cut ends and rough edges smooth. Bevel the cut end slightly for push-on connections as per manufacturer recommendations.
- M. In distributing material at the site of the Work, unload each piece opposite or near the place where it is to be laid in the trench. If the pipe is to be strung out, do so in a straight line or in a line conforming to the curvature of the street. Block each length of pipe adequately to prevent movement. Block stockpiled pipe adequately to prevent movement. Do not place pipe, material, or any other object on private property, obstructing walkways or driveways, or in any manner that interferes with the normal flow of traffic.



- N. Exercise special care to avoid damage to the bells, spigots or flanged ends of pipe during handling, temporary storage, and construction. Replace damaged pipe that cannot be repaired to the AW'S satisfaction, at the Contractor's expense.
- O. Remove all existing pipe, fittings, valves, pipe supports, blocking, and all other items necessary to provide space for making connections to existing pipe and installing all piping required under this Contract.
- P. Maintain the minimum required distance between the water and sewer lines and other utility lines in strict accordance with all Federal, State, and local requirements and all right-of-way limitations.
- Q. Provide and install polyethylene encasement for ductile iron pipe as required by the Drawing or Specification Special Conditions. See Specification Section 15130, as applicable.
- R. The maximum allowable deflection at the joints for push-on joint pipe shall be the lesser of manufacturer's recommendations or as described in the DIPRA Guideline, *Ductile Iron Pipe Joints and Their Uses*, as follows:

<u>Size of Pipe</u>	<u>Deflection Angle</u>	<u>Maximum Deflection</u> <u>(18-ft. Length) (20-ft. Length)</u>	
3"-12"	5 degrees	19"	21"
14"-42"	3 degrees	11"	12"
48"-64"	3 degrees	N/A	12"

- S. Use short lengths of pipe (minimum length 3 feet, no more than three short sections), when approved by the Engineer, to make curves that cannot be made with full length sections of pipe without exceeding the allowable deflection. Making these curves will be at no additional cost to the Owner.
- T. Furnish air relief valve assemblies in accordance with detail drawings provided or as specified in the specification Special Conditions section. Engineer will provide standard detail for additional air release valve assemblies. Any deviation from the standard detail proposed by contractor must be approved in advance.
- U. Exercise particular care so that no high points are established where air can accumulate. Install an air release valve and manhole, as extra Work to the Contract, when the Engineer determines that unforeseen



field conditions necessitate a change in the pipe profile that requires the installation of an air release valve and manhole. If the Contractor requests a change in the pipe profile solely for ease of construction, and the requested change requires the installation of an air release valve and manhole as determined by the Engineer, the cost of furnishing and installing the air release valve and manhole will be at the expense of the Contractor.

- V. All water mains 20" and greater in diameter shall be constructed using DIP only. Other construction materials, such as PVC and HDPE, are limited to water mains 16" and under in diameter.

## .02 CONSTRUCTION METHODS TO AVOID CONTAMINATION

- A. Heavy particulates generally contain bacteria and prevent even very high chlorine concentrations from contacting and killing such organisms. It is essential that the procedures of this Specification Section be observed to assure that a water main and its appurtenances are thoroughly clean for the final disinfection by chlorination.
- B. Take precautions to protect the interior of pipes, fittings, and valves against contamination. String pipe delivered for construction so as to keep foreign material out of the pipe. Close all openings in the pipeline with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods. Use rodent-proof plugs approved by AW, where it is determined that watertight plugs are not practical and where thorough cleaning will be performed.
- C. Delay in placement of delivered pipe invites contamination. The more closely the rate of delivery is correlated to the rate of pipe laying, the lower the likelihood of contamination. Complete the joints of all pipe in the trench before stopping work. If water accumulates in the trench, keep the plugs in place until the trench is dry.
- D. When encountering conditions on pre-existing pipe that requires packing, employ yarning or packing material made of molded or tubular rubber rings, or rope of treated paper or other approved materials. Do not use materials such as jute, asbestos, or hemp. Handle packing material in a manner that avoids contamination.

- E. Do not use contaminated material or any material capable of supporting prolific growth of microorganisms for sealing joints. Handle sealing material or gaskets in a manner that avoids contamination. The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water. Deliver the lubricant to the job in closed containers and keep it clean.
  - F. If dirt enters the pipe, and in the opinion of AW the dirt will not be removed by the flushing operation, clean the interior of the pipe by mechanical means, then swab with a 1% hypochlorite disinfecting solution. Clean using a pig, swab, or "go-devil" only when AW has specified such and has determined that such operation will not force mud or debris into pipe joint spaces.
  - G. If the main is flooded during construction, the flooded section must be isolated from the remainder of the installation as soon as practical. Submit a plan to AW on correcting the condition and do not proceed until authorized by AW. Replace or fully clean and disinfect the affected pipe at no additional cost to AW.
- .03 VALVE INSTALLATION
- A. Prior to installation, inspect valves for direction of opening, freedom of operation, tightness of pressure containing bolting, cleanliness of valve ports and especially of seating surfaces, handling damage, and cracks. Correct defective valves or hold for inspection by the Engineer.
  - B. Set and join to the pipe in the manner specified in Specification Section 3.01. Provide valves with adequate support, such as crushed stone and concrete pads, so that the pipe will not be required to support the weight of the valve. Set truly vertical. After field installation of the valve all exposed ferrous restraint materials and external bolts except the operating nut shall receive a layer of petrolatum tape coating or, where approved, rubberized-bitumen based spray-on undercoating applied before backfill. If polyethylene is applied to the pipe, the entire valve shall be encased in polyethylene encasement prior to backfill. The polyethylene encasement shall be installed up to the operating nut leaving the operating nut exposed and free to be operated.
  - C. Provide a valve box for each valve. Set the top of the valve box neatly to existing grade, unless directed otherwise by AW. Do not install in a way that allows the transfer shock or stress to the valve. Center and plumb the box over the wrench nut of the valve. Do not use valves to

bring misaligned pipe into alignment during installation. Support pipe in such manner as to prevent stress on the valve.

- D. Provide valve marking posts, when authorized by AW, at locations designated by AW and in accordance with detail drawings.

#### .04 THRUST RESTRAINT

- A. Provide all plugs, caps, tees, and bends (both horizontal and vertical) with concrete thrust blocking and/or restrained joint pipe as represented on the Drawings, or specified in the Specification Special Conditions.
- B. Place concrete thrust blocking between undisturbed solid ground and the fitting to be anchored. Install the concrete thrust blocking in accordance with Specification Section 03300 and standard details provided. Locate the thrust blocking to contain the resultant thrust force while keeping the pipe and fitting joints accessible for repair, unless otherwise shown or directed.
- C. Provide temporary thrust restraint at temporary caps and plugs. Submit details of temporary restraint to AW for approval.
- D. At connections with existing water mains where there is a limit on the time the water main may be removed from service, use metal harnesses of anchor clamps, tie rods and straps; mechanical joints utilizing set-screw retainer glands; or restrained push-on joints as permitted by AW. No restraining system can be installed without the approval of AW. Submit details of the proposed installation to AW for approval. For pipe up to 12 inches in size, use a minimum of two 3/4-inch tie rods. If approved for use, install retainer glands in accordance with the manufacturer's instructions. Material for metal harnessing and tie-rods shall be ASTM A36 or A307, as a minimum requirement.
- E. Protection of Metal Harnessing: Protect ties rods, clamps and other metal components against corrosion by hand application of petrolatum tape and by encasement of the entire assembly with 8-mil thick (12 mil thick in corrosive soils) loose polyethylene film in accordance with AWWA C105. Apply tape on all exposed tie rods prior to installing polyethylene.

**END OF SECTION 15000**



## SECTION 15020

### DISINFECTING PIPELINES

#### PART 1 GENERAL

##### **.01 SCOPE OF WORK**

Flush and disinfect all pipelines installed under this Contract if indicated in the summary of work. This would include furnishing the necessary labor, tools, transportation, and other equipment for the operation of valves, hydrants, and blowoffs during the chlorination. Install, and if directed remove, all chlorination taps required for disinfection. The cost of this work shall be included in the bid item for pipe installation. The disinfection will be performed under the supervision of AW.

##### **.02 WORK BY OWNER**

AW reserves the option to provide/furnish the chlorine and chlorination equipment. AW will furnish water for testing, flushing and disinfecting pipelines. AW will also reserve the right to perform bacteriological testing and may collect the sample.

##### **.03 PROTECTION**

Chlorine disinfection and dechlorination shall be under the direct supervision of someone familiar with the physiological, chemical, and physical properties of the form of chlorine used. They shall be trained and equipped to handle any emergency that may arise. All personnel involved shall observe appropriate safety practices to protect working personnel and the public.

The forwards of AWWA Standards B300 and B301 contain information and additional reference material regarding the safe handling of hypochlorites and liquid chlorine. The Contractor shall familiarize himself with this information prior to performing any disinfection work.

##### **.04 RELATED WORK**

Observe the precautions described in Specification Section 15000 to avoid contamination during installation of the pipeline.



## **.05 REFERENCES**

Refer to current AWWA Standard for Disinfecting Water Mains C651.

## **PART 2 PRODUCTS**

### **.01 MATERIALS AND EQUIPMENT**

- A. Furnish liquid chlorine and injection equipment and/or calcium hypochlorite (HTH) as needed to disinfect all pipelines and appurtenances.
- B. Liquid chlorine contains 100% available chlorine and is packaged in steel containers, usually of 100 lb, 150 lb, or 1 ton net chlorine weight. Liquid chlorine is to be furnished in accordance with AWWA B301.
- C. Calcium hypochlorite is available in granular form or in approximately 5-g tablets, and contains approximately 65% available chlorine by weight. The material should be stored in a cool, dry, and dark environment to minimize its deterioration. Do not use calcium hypochlorite intended for swimming pool disinfection, as this material (containing trichloroisocyanuric acid) has been sequestered and is extremely difficult to eliminate from the pipe after the desired contact time had been achieved.
- D. Calcium hypochlorite must conform to AWWA B300.

## **PART 3 EXECUTION**

### **.01 PREPARATION**

All pipelines shall be pressure and leak tested, flushed, and cleaned of debris and dirt prior to application of the disinfectant. Flushing shall continue until the volume in the newly installed main has turned over at least one time unless AW determines that conditions do not permit the required volume to be safely discharged to waste.



## **.02 APPLICATION OF DISINFECTANT**

Methods to be used for disinfection are those detailed in ANSI/AWWA C651 Disinfecting Water Mains.

## **.03 WATER MAINS**

Three (3) methods of chlorination are described below. The third method, using tablets of hypochlorite, is only permitted by expressed approval of AW and under no circumstance allowed for projects of 2000 feet or more. Otherwise, information in the forward of AWWA Standard C651 will be helpful in determining the best method to be used.

### **A. Continuous Feed Method**

#### **1. Set up**

The continuous feed method consists of completely filling the main to remove all air pockets, flushing the completed main to remove particulates, and then refilling the main with chlorinated potable water. The potable water shall be chlorinated, so that after a 24-hour holding period in the main, there will be a free chlorine residual of not less than 10 mg/L in collected samples.

Chlorine can be applied in advance of preliminary flushing by swabbing joints with bleach or placing hypochlorite granules in the pipe in areas where contamination is suspected. In any such case, the contractor shall make sure and take appropriate action to make sure that the flushed water is dechlorinated.

Preliminary flushing. Prior to being chlorinated, fill the main to eliminate air pockets and flush to remove particulates. The flushing velocity in the main shall be not less than 2.5 fps unless the Engineer determines that conditions do not permit the required flow to be discharged to waste. Table 1 shows the rates of flow required to produce a velocity of 2.5 fps in pipes of various sizes.

NOTE: Flushing is no substitute for preventive measures during construction. Certain contaminants such as caked deposits resist flushing at any feasible velocity.



**TABLE 1**  
Required Flow and Openings to Flush Pipelines  
(40 psi Residual Pressure in Water Main)\*

Pipe Diameter (inches)	Flow required to produce 2.5 fps velocity in main (gpm)	Size of Tap. (inches)			Number of Hydrant Outlets To Use
		1	1-1/2	2	
		Number of taps on Pipe <sup>†</sup>			
4	100	1	-	-	1
6	200	-	1	-	1
8	400	-	2	1	1
10	600	-	3	2	1
12	900	-	-	2	2
16	1600	-	-	4	2

\*With a 40 psi pressure in the main with the hydrant flowing to atmosphere, a 2½-inch hydrant outlet will discharge approximately 1,000 gpm and a 4½-inch hydrant outlet will discharge approximately 2,500 gpm.

† Number of taps on pipe based on discharging through 5 feet of galvanized iron pipe with one 90 degree elbow.

In mains of 24-inches or larger diameter, an acceptable alternative to flushing is to broom-sweep the main, carefully removing all sweepings prior to chlorinating the main.

## 2. Chlorinating the Main.

- a. Flow water from the existing distribution system or other approved source of supply at a constant, measured rate into the newly laid water main. In the absence of a meter, approximate the rate by placing a pitot gauge in the discharge or measuring the time to fill a container of known volume.
- b. At a point not more than 10 feet downstream from the beginning of the new main, dose the water entering the new main with chlorine fed at a constant rate such that





the water will have not less than 25 mg/L free chlorine. Measure the chlorine concentration at regular intervals to ensure that this concentration is provided. Measure chlorine in accordance with the procedures described in the current edition of the AWWA Manual M12 or of *Standard Methods for the Examination of Water and Wastewater*.

- c. Table 2 gives the amount of chlorine required for each 100 feet of pipe of various diameters. Solutions of 1 percent chlorine may be prepared with calcium hypochlorite. The solution requires 1 pound of calcium hypochlorite in 8 gallons of water.

**TABLE 2**  
 Chlorine Required to Produce 25 mg/L  
 Concentration in 100 feet of Pipe by Diameter

Pipe Diameter inches	100 Percent Chlorine lbs	1 Percent Chlorine Solutions gallons
4	0.013	0.16
6	0.030	0.36
8	0.054	0.65
10	0.085	1.02
12	0.120	1.44
16	0.217	2.60

- d. During the application of chlorine, position valves so that the strong chlorine solution in the main being treated will not flow into water mains in active service. Do not stop the chlorine application until the entire main is filled with heavily chlorinated water. Keep the chlorinated water in the main for at least 24 hours. During this time, operate all valves and hydrants in the section treated in order to disinfect the appurtenances. At the end of this 24-hour period, the treated water in all portions of the main shall have a residual of not less than 10 mg/L free chlorine.
- e. Hypochlorite solution may be applied to the water main with a gasoline or electrically powered chemical





feed pump designed for feeding chlorine solutions. Feed lines shall be of such material and strength as to safely withstand the corrosion caused by the concentrated chlorine solutions and the maximum pressures that may be created by the pumps. Check all connections shall for tightness before the solution is applied to the main.

- f. If gaseous chlorine in solution is permitted by the Engineer and proposed by the contractor, the preferred equipment for the gas application employs a feed vacuum-operated chlorinator to mix the chlorine gas, in combination with a booster pump for injecting the chlorine gas solution water into the main to be disinfected. Direct feed chlorinators cannot be used. (A direct feed chlorinator is one which operates solely from the pressure in the chlorine cylinder.)

## B. Slug Method

### 1. Setup

- a. The slug method consists of placing calcium hypochlorite granules in the main during construction; completely filling the main to eliminate all air pockets, flushing the main to remove particulates, and slowly flowing a slug of water containing 100 mg/L of free chlorine through the main so that all parts of the main and its appurtenances will be exposed to the highly chlorinated water for a period of not less than 3 hours.

### 2. Chlorinating the main.

- a. At the option of AW, place calcium hypochlorite granules in the main during construction. The purpose of this procedure is to provide a strong chlorine concentration in the first flow of flushing water especially to fill annular spaces in pipe joints. Flush the main to eliminate air and remove particulates to include management of dechlorination and discharged water.



- b. At a point not more than 10 feet downstream from the beginning of the new main, dose the water entering the new main with chlorine fed at a constant rate such that the water will have not less than 100 mg/L free chlorine. Measure the chlorine concentration at regular intervals to ensure that this concentration is provided. Measure chlorine in accordance with the procedures described in the current edition of the AWWA Manual M12 or of *Standard Methods for the Examination of Water and Wastewater*. The chlorine shall be applied continuously and for a sufficient period to develop a solid column or "slug" of chlorinated water that will, as it moves through the main, expose all interior surfaces to a concentration of approximately 100 mg/L for at least 3 hours.
- c. The free chlorine residual shall be measured in the slug as it moves through the main. If at any time it drops below 50 mg/L, stop the flow, relocate the chlorination equipment to the head of the slug, and as flow is resumed, apply chlorine to restore the free chlorine in the slug to not less than 100 mg/L.
- d. As the chlorinated water flows past fittings and valves, operate related valves and hydrants so as to disinfect appurtenances and pipe branches.

C. Tablet Method

1. Setup

- a. The tablet method consists of adhering calcium tablets in the water main as it is being installed and then filling the main with potable water when installation is completed. This method may be used only if the pipes and appurtenances are kept clean and dry during construction and with permission by AW for short main installations.

2. Chlorinating the Main –

- a. Placing of calcium hypochlorite tablets - *Placing of calcium hypochlorite tablets*. During construction, 5-g calcium hypochlorite tablets shall be placed in each



section of pipe. Also, one such tablet shall be placed in each hydrant, hydrant branch, and other appurtenance. The number of 5-g tablets required for each pipe section shall be  $0.0012 d^2 L$  rounded to the next higher integer, where  $d$  is the inside pipe diameter, in inches, and  $L$  is the length of the pipe section, in feet. Table 1 shows the number of tablets required for commonly used sizes of pipe. The tablets shall be attached by a food-grade NSF approved adhesive. There shall be no adhesive on the tablet except on the broadside attached to the surface of the pipe and no adhesive applied or spilled on the pipe surface. Excess adhesive must be removed immediately using mechanical means or an NSF approved adhesive solvent. Attach all the tablets inside and at the top of the main, with approximately equal numbers of tablets at each end of a given pipe length. If the tablets are attached before the pipe section is placed in the trench, their position shall be marked on the section so it can be readily determined that the pipe is installed with the tablets at the top.

		Length of Pipe Section, ft (m)				
Pipe Diameter		13(4.0) or less	18(5.5)	20(6.1)	30(9.1)	40(12.2)
<i>in.</i>	<i>(mm)</i>	Number of 5-g Calcium Hypochlorite Tablets				
6	(150)	1	1	1	2	2
8	(200)	1	2	2	3	4
12	(300)	3	4	4	6	7
16	(400)	4	6	7	10	13

- b. *Filling and contact.* When installation has been completed, the main shall be filled with water at a rate such that water within the main will flow at a velocity no greater than 1 ft/s (0.3 m/s). Precautions shall be taken to ensure that air pockets are eliminated. This water shall



remain in the pipe for at least 24 hours. If the water temperature is less than 41°F (5°C), the water shall remain in the pipe for at least 48 hours.

#### **.04 DISPOSAL OF HEAVILY CHLORINATED WATER**

- A. Do not keep heavily chlorinated water in contact with pipe for more than 48 hours after the applicable retention period. In order to prevent damage to the pipe lining or corrosion damage to the pipe itself, flush the heavily chlorinated water from the main fittings, valves, and branches until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the system or is acceptable for domestic use. Take all steps necessary to dechlorinate water where required per section 3.04B and 3.04C below. Contact the local sewer department to arrange for disposal of the heavily chlorinated water to the sanitary sewer if applicable.
- B. Neutralize the chlorine residual of the water being disposed of by treating with one of the chemicals listed in Table 3. Select an alternative disposal site if a sanitary sewer system is unavailable for disposal of the chlorinated water.
- C. The proposed alternative disposal site shall be inspected and approved of by AW. Apply a reducing agent to the chlorinated water to be wasted to completely neutralize the chlorine residual remaining in the water. (See Table 3 for neutralizing chemicals. Do not overdose neutralizing chemicals as this may result in adverse environmental impacts. Only dose the amount required to neutralize the amount of chlorine present). Contact federal, state and local regulatory agencies, where necessary, to determine special provisions for the disposal of heavily chlorinated water.



**Table 3**  
Pounds of chemicals required to neutralize various  
residual chlorine concentrations in 100,000 gallons of water.

Residual Chlorine Concentration	Sulfur Dioxide	Sodium Bisulfite	Sodium Sulfite	Sodium Thiosulfate	Ascorbic Acid
<u>mg/L</u>	<u>(SO<sub>2</sub>)</u>	<u>(NaHSO<sub>3</sub>)</u>	<u>(Na<sub>2</sub>SO<sub>3</sub>)</u>	<u>(Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> · 5H<sub>2</sub>O)</u>	
1	0.8	1.2	1.4	1.2	2.1
2	1.7	2.5	2.9	2.4	4.2
10	8.3	12.5	14.6	12.0	20.9
50	41.7	62.6	73.0	60.0	104.0

- D. Test for chlorine residual throughout the disposal process to be sure that the chlorine is neutralized
- E. Submit a plan of disposal of flushed water to AW for approval

## **.05 BACTERIOLOGICAL TESTING**

- A. After final flushing and before the water main is placed in service, the first of two consecutive sets of acceptable samples can be collected from the new main. The second set of samples must be taken at least 24 hours after the first set of samples. The main should not be flushed between collection of the first and second set of samples except to clear the sample site to collect the second sample. At least one set of samples shall be collected from every 1,200 feet, of the new water main, plus one set from the end of the line and at least one set from each branch when possible or as required by regulatory requirements.
- B. Samples shall be collected by a person knowledgeable in collecting samples for bacteriological sampling or arrange for the Owner to collect the sample. Coordinate with Owner and submit samples to the Owner for testing of bacteriological (chemical and physical) quality. Testing will be in accordance with Standard Methods of the Examination of Water and Wastewater. Samples shall show the absence of coliform



organisms; and the presence of a chlorine residual. Samples shall also be tested for turbidity, pH, and standard heterotrophic plate count (HPC). HPC levels must be consistent with levels normally found in the distribution system to which the new main is connected.

- C. Bacteriological tests must show complete absence of coliforms and acceptable HPCs. If tests show the presence of coliform or unacceptable HPCs, perform additional flushing and disinfection of the pipeline until acceptable tests are obtained, all at no cost to the Owner. The Contractor will not be charged for the additional testing performed by the Owner.

**.06****RETESTING AND TESTING SOURCE WATER**

- A. At the time of initial flushing the main to remove material and test for air pockets, Contractor may request AW to continue flushing until the desired chlorine residual is met at the discharge point. Notification must be provided in advance and the Contractor shall be prepared to test for chlorine at intervals of no more than five minutes as the water clears. This will provide the Contractor with some assurance that the source water is chlorinated.
- B. If the subsequent tests for bacteriological contamination conducted by the Contractor fail, the Contractor may request the Owner to continue flush from the source water into the new pipe system until a chlorine residual is found at the discharge point. Notification must be provided in advance and the Contractor shall be prepared to test for chlorine at intervals of no more than five minutes as the water clears. The operation of all existing system valves shall be by the Owner at the Contractor expense and the discharge point must be opened prior to opening existing valves to avoid contamination. This will provide the Contractor with some assurance that the source water is chlorinated for subsequent tests.

**END OF SECTION 15020**

## **SECTION 15025**

### **CLEANING PIPELINES**

#### **PART 1 GENERAL**

##### **.01 SCOPE OF WORK**

Clean the pipelines installed under these Contract Documents using foam pigs, swabs, or "go-devils", as described herein, whenever normal flushing will not sufficiently remove dirt and debris that was introduced during construction.

##### **.02 GENERAL**

Normal pipeline flushing is often inadequate to remove all the entrapped air, loose debris, and other objects that may have been left in the main during installation. In such cases, use polyurethane foam pigs and/or polyurethane hard foam swabs to remove all foreign matter from the pipeline (i.e. "pig" the pipeline). Clean the pipeline per the requirements of this Specification Section prior to testing and disinfecting the main.

##### **.03 RELATED WORK**

See Specification Section 15000.3.02 - Construction Methods to Avoid Contamination and Specification Section 15020.3.01-Preparation (prior to disinfecting pipelines).

##### **.04 PROTECTION DURING FLUSHING AND CLEANING**

Coordinate with AW before flushing to ensure that an adequate volume of flushing water is available, at sufficiently high pressure. Determine if the water can be disposed of safely. Notify AW and the following prior to flushing, or cleaning:

- a. Fire Department
- b. Other utilities, such as gas, electric and telephone companies, who may have underground facilities in the area.
- c. Customers who may be inconvenienced by reduced pressure or dirty water.

Coordinate with AW to isolate the section to be flushed from the operating distribution system. Close valves slowly to prevent water hammer. Open



the fire hydrant or blow-off valve slowly until the desired flow rate is obtained. When flushing from a dry barrel fire hydrant, use the gate valve upstream of the hydrant for throttling purposes. Open the hydrant valve fully to prevent water from escaping into the ground through the fire hydrant barrel drain.

Protect the work staff and the public during operation of hydrants and valves. Keep children away from the flow of flushing water. Where practical employ energy dissipators to help avoid damage to property and the flooding of streets. The safety considerations also apply to main cleaning.

## **PART 2 PRODUCTS**

### **.01 MATERIALS AND EQUIPMENT**

Furnish the foam cleaning plugs (swabs or pigs), labor, and equipment as needed to pig all pipelines. Furnish all materials required for the expulsion of air and other debris from pipelines. Do not use of pipe cleaning plugs which utilize Bristles, wire brushes, carbide abrasives, steel studs, or any other Type abrasive unless specifically approved by AW. Consult a manufacturer of pipe cleaning plugs, such as Knapp Polly Pig (Houston, Texas), to determine the type and size of cleaning plug best suited for the application. Two types of plugs shall be considered and are described as follows:

#### **A. Swabs**

Swabs used for cleaning mains shall be made of polyurethane foam. This foam has a density of 1 to 2 pounds per cubic feet. Swabs shall be purchased from commercial manufacturers of swabs for pipes. Both soft and hard grade foam swabs are available. New mains are typically cleaned with hard foam swabs.

Use swabs cut into cubes and cylinders slightly larger than the size of the pipe to be cleaned. Cubes one inch larger in dimension than the nominal diameter of the pipe being cleaned have worked well for cleaning pipes up to 12-inches in diameter. For mains greater than 12-inches in diameter, the swab diameter must be considered individually for each operation. For new mains, swabs 3-inches larger than the pipe diameter have worked well. Swabs for the larger mains are usually 1-1/2 times the diameter in length.



**B. Pigs**

The other type of cleaning plug available is called a pig. Pigs, if used, shall be commercially manufactured for the specific purpose of cleaning pipes. They shall be made of polyurethane foam weighing 2 to 15 lb./cu.ft. Pigs are bullet shaped and come in various grades of flexibility and roughness. Pigs are typically 1/4 - inch to 1/2-inch larger in diameter than the pipe to be cleaned.

**PART 3 EXECUTION****.01 PLUG INSTALLATION AND REMOVAL**

Furnish all equipment, material, and labor to satisfactorily expose cleaning wyes, or other entry or exit points. Remove cleaning wye covers, etc., as required by the Engineer to insert the plugs into the mains.

If approved by AW, stripped fire hydrants, air valves and blow-offs may serve as entry and exit points for smaller sized mains. AW will examine these appurtenances and the connecting laterals to ensure that adequate openings exist through which a plug may be launched.

If these appurtenances are used, a special launcher is required to ease the insertion and launching of the plug. If available, a pressurized water source such as a fire hydrant can be used to launch the plug. If water from the system is not available nearby, use a water truck with pump.

If hydrants are used as entry and/or exit points, remove the internal mechanisms and plug the drains under the supervision of the Engineer. Insert the plug and replace the cap with a special flange with a 2-1/2-inch fitting. Connect the 2-1/2-inch fitting, with a pressure gauge and valve, to a pressurized water source. After closing the last valve isolating the section to be cleaned, open the hydrant supply valve. Propel the swab or pig into the main by opening the exit valve.

In mains greater than 8-inches, wyes shall be used at the entry and exit points. Fabricate the wye section one size larger than the main to ease the insertion and extraction of the plug. The use of wyes, as with the previously mentioned appurtenances, requires an outside source of pressurized water for launching. Cap the wye with a flange with a 2 to 6 inch fitting for connecting to the pressurized water source.

Many pigs are harder to insert into a pipe since they are less flexible than swabs. Other methods acceptable to insert pigs include:

1. winching with a double sling,
2. winching with a rope attached to the pig,
3. compression with a banding machine prior to insertion, and
4. the use of a specially designed tapered steel pipe which is removed after use.

During swab or pig installation, leave as much water as possible in the main to be cleaned. The water suspends the material being removed from the pipe and minimizes the chance of the material forming a solid plug. Water in the pipe also keeps the swab or pig from traveling through the pipe at excessive rates. If swabs or pigs travel too fast, they will remove less material and wear more rapidly.

At the exit point or blow-off, install a wye long enough to house the swab or pig. Attach temporary piping to the end cap to allow the drainage of the water.

Take precautions to prevent backflow of purged water into the main when the cleaning plug exits through a dead end main. This can be accomplished by installing mechanical joint bends and pipe joints to provide a riser out of the trench. Additional excavation of the trench may serve the same purpose.

## **.02 PRE-CLEANING PROCEDURES**

- A. Prepare a written cleaning plan for the AW's review,
- B. Suggested pre-cleaning procedures include:
  1. Identify mains to be cleaned on a map. Mark the location of the entry, water supply, exit points, any blow-offs to be used, valves to be closed, and the path of the swab or pig.
  2. Under AW's supervision, inspect and operate all valves and hydrants to be used in the cleaning operation to ensure their correct operation and a tight shutdown.
  3. Check location and type of hydrants, launch and exit location, and blow-offs to be used. Make blow-off tap connections, if necessary.

4. AW will notify customers served by the main to be cleaned that their water will be off for a specified period of time on the day of the cleaning.
5. AW will identify customers who may require temporary services during the main cleaning operation. The Contractor shall provide the temporary connections.
6. Determine the number and size of plugs to be used.

### **.03 CLEANING PROCEDURE**

Clean the pipeline using the following procedures and the Contractor's cleaning plan, as approved by AW.

#### **A. Swab Cleaning Procedures**

1. Open the water supply upstream of the swab. Throttle the flow in the main at the discharge (plug exit) point so that the swab passes through the main at a speed of 2 to 4 fps. (At this velocity, swabs will effectively clean pipes for distances of up to 4,000 feet before disintegrating to a size smaller than the main.) Use pitot gauges at the exist hydrant or blow-off to estimate the flowrate in the main.
2. Note the time of entry of the swab into the main and estimate its time of exit. If the swab does not reach the exit point in the estimated time plus ten minutes, then a blockage has probably occurred. Reverse the flow in the main and note the time required for the swab to reach the original entry point. From the return travel time, estimate the location of the blockage. The Engineer may require the use of a swab containing a transmitter to accurately locate the blockage.
3. Swab repeatedly as needed. Stop swabbing when the water behind the swab emerging at the exit clears up within one minute. Account for all swabs inserted into the main.
4. After the last swab has been recovered, flush the main to remove swab particles. This may require up to an hour of flushing.

**B. Pig Cleaning Procedures**

1. Remove all air valves along the line. Insure that each isolating valves to the air release valve are completely closed. Operate system to prevent undesired build up of air while air release valves are out of service.
2. If the pig is inserted directly into the main, set it in motion by opening the upstream gate valve and a downstream fire hydrant or blow-off valve (usually the valve on the capped end at the exit point). If the pig is launched from a wye, fire hydrant, or other appurtenance, use an external pressurized water source to inject the pig into the main as described in Specification Section 3.01.
3. Once the pig is launched, control its speed by throttling the discharge at a downstream fire hydrant or blow-off. Operate pigs at the typical speed of 1 fps. This slow speed will help prevent pressure surges when the pig passes through undersized valves, enters smaller pipes, or turns through tees or crosses. Speeds of up to 2 fps. can be used on straight runs with no restrictions or sharp turns.
4. Make sufficient passes of the pig to obtain thorough cleaning. Two pigs may be used in tandem to save time and water. Sufficient cleaning is established when the water discharging after the pig becomes clear within one minute.

**.04 POST CLEANING PROCEDURE**

After successful cleaning; test, flush, and disinfect the main in accordance with applicable sections of these Specifications.

**END OF SECTION 15025**

**SECTION 15030****PRESSURE AND LEAKAGE TESTS****PART 1 GENERAL****.01 SCOPE OF WORK**

Test all piping, valves, and appurtenances installed under these Contract Documents. Testing shall be performed concurrent with installation. Do not install more than 1,200 feet of pipe without being tested, unless approved by AW.

**.02 SUBMITTALS**

Prepare and submit schedules and procedures to AW for testing of all parts of the water main installed in accordance with these Contract Documents. Submit the schedule at least seven days prior to any testing.

**PART 2 PRODUCTS****.01 EQUIPMENT**

Furnish the pump, pipe connections, and all necessary apparatus for the pressure and leakage tests including gauges and metering devices. AW reserves the option to furnish the gauges and metering devices for the tests. Excavate, backfill, and furnish all necessary assistance for conducting the tests.

**PART 3 EXECUTION****.01 GENERAL**

- A. Perform hydrostatic pressure and leak tests in accordance with AWWA C600, Section 4 - Hydrostatic Testing after the pipe or section of pipe has been laid, thrust blocking cured (min. 5 days), and the trench is completely or partially backfilled. Where practical, testing shall be performed fully isolated from the active distribution system.
- B. The Contractor may, at his option, completely backfill the trench or partially backfill the trench over the center portion of each pipe section to be tested. However, AW may direct the Contractor to completely backfill the trench if local traffic or safety conditions require.

- C. For system operating pressures of 200 psi or less, perform the hydrostatic test at a pressure of no less than 100 psi above the normal operating pressure without exceeding the rating of the pipe and appurtenances. For system operating pressures in excess of 200 psi, perform the hydrostatic test at a pressure that is 1.5 times the normal operating pressure, but no more than the design rating of the pipe and appurtenances.
- D. Valves shall not be operated in either direction at a differential pressure exceeding the rated valve working pressure. A test pressure greater than the rated valve working pressure can result in trapped test pressure between the gates of a double-disc gate valve. For tests exceeding the rated valve working pressure, the test setup should include a provision, independent of the valve, to reduce the line pressure to the rated valve working pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or the valve can be fully opened if desired.
- E. The test pressure shall not exceed the rated working pressure or differential pressure of the valves when the pressure boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.
- F. Attach a tapping sleeve and valve assembly to the main. Pressure test the assembly prior to making the tap. The required test pressure shall be determined in the same manner as for pipe. The test is acceptable if there is no pressure drop in 15 minutes at test pressure.

## **.02 FILLING AND TESTING**

- A. Slowly fill each segregated section of pipeline with water ensuring that all air is expelled. Extreme care must be taken to ensure that all air is expelled during the filling of pipe. The line shall stand full of water for at least twenty-four hours prior to testing to allow all air to escape. If necessary, tap the main at points of highest elevation to expel air as the pipe is filled. Remove the corporation stops and plug the taps after successfully filling the pipeline and expelling all air as approved by AW.
- B. Apply the specified test pressure, measured at the point of lowest elevation, using a pump connected to the pipe in a manner satisfactory to the Engineer. If the elevation of the high point of the pipeline being tested is such that the pressure during testing will be below 85% of the required test pressure, AW will require a separate test to be performed on this section of pipeline. In lieu of a separate test, the test pressure measured at the lowest elevation may be increased, within the pressure rating of the

pipeline material, such that the resulting pressure at the highest point exceeds 85% of the required test pressure. The test will be conducted for at least two hours at the required test pressure  $\pm 5$  psi.

- C. Conduct a leakage test concurrently with the pressure test. Leakage is defined as the volume of the water that must be supplied into the newly laid pipeline to maintain pressure within 5 psi of the test pressure after it is filled and purged of air. Measure the volume of water using a calibrated container or meter.
- D. No pipeline installation will be accepted by AW if the leakage is greater than that shown in the following table:

**Allowable Leakage per 1000 ft. of Pipeline\*---gph**

Avg. Test Pressure <i>psi</i>	Nominal Pipe Diameter--- <i>in.</i>													
	4	6	8	10	12	14	16	18	20	24	30	36	42	48
450	0.57	0.86	1.15	1.43	1.72	2.01	2.29	2.58	2.87	3.44	4.30	5.16	6.02	6.88
400	0.54	0.81	1.08	1.35	1.62	1.89	2.16	2.43	2.70	3.24	4.05	4.86	5.68	6.49
350	0.51	0.76	1.01	1.26	1.52	1.77	2.02	2.28	2.53	3.03	3.79	4.55	5.31	6.07
300	0.47	0.70	0.94	1.17	1.40	1.64	1.87	2.11	2.34	2.81	3.51	4.21	4.92	5.62
275	0.45	0.67	0.90	1.12	1.34	1.57	1.79	2.02	2.24	2.69	3.36	4.03	4.71	5.38
250	0.43	0.64	0.85	1.07	1.28	1.50	1.71	1.92	2.14	2.56	3.21	3.85	4.49	5.13
225	0.41	0.61	0.81	1.01	1.22	1.42	1.62	1.82	2.03	2.43	3.04	3.65	4.26	4.86
200	0.38	0.57	0.76	0.96	1.15	1.34	1.53	1.72	1.91	2.29	2.87	3.44	4.01	4.59
175	0.36	0.54	0.72	0.89	1.07	1.25	1.43	1.61	1.79	2.15	2.68	3.22	3.75	4.29
150	0.33	0.50	0.66	0.83	0.99	1.16	1.32	1.49	1.66	1.99	2.48	2.98	3.48	3.97
125	0.30	0.45	0.60	0.76	0.91	1.06	1.21	1.36	1.51	1.81	2.27	2.72	3.17	3.63
100	0.27	0.41	0.54	0.68	0.81	0.95	1.08	1.22	1.35	1.62	2.03	2.43	2.84	3.24

\*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size. The table has been generated from the formula:  $L = \frac{S \cdot D \cdot P^{1/2}}{148,000}$  where L is the allowable leakage in gallons per hour, S is the length of pipe in feet, D is the nominal pipe diameter in inches, and P is the test pressure in psig.

- E. Should any test disclose damaged or defective materials or leakage greater than that permitted, the Contractor shall, at Contractor's expense, locate and repair and/or replace the damaged or defective materials. Materials used for repair must be approved by AW and meet the specifications. Repeat the tests until the leakage is within the permitted allowance and is satisfactory to AW

**END OF SECTION 15030**



## SECTION 15050

### WATER TAP AND SERVICE LINE INSTALLATION

#### PART1 GENERAL

##### .01 SECTION INCLUDES

- A. Tapping existing and or new watermains and furnishing and installing new service lines for water.
- B. Relocation of existing small water meters.
- C. Specifications identify requirements for both small-diameter (less than or equal to 20 inches) watermains and large-diameter (greater than 20 inches) watermains. When specifications for large-diameter watermains differ from those for small- diameter watermains, paragraphs for large-diameter watermains will govern for large-diameter pipe.

##### .02 DEFINITIONS

- A. Short Side Connection Service Line: Installation of a new corporation main stop and connecting a new length of proposed water service piping between the new proposed watermain to the existing water service piping connected to the existing watermain located on same side of street as to where the new watermain is being constructed.
- B. Long Side Connection Service Line: Installation of a new corporation main stop, and connection to the existing water service piping that provides water service to the buildings on the opposite side (long side) of the street from of the centerline of the proposed new watermain.

#### PART 2 PRODUCTS

##### .01 MATERIALS

- A. Copper Tubing: Provide Type 'K' copper service lines. Where existing service piping is determined to be 'Copper' new service piping shall be 'Copper Tubing' to match existing.
- B. Polyethylene Pipe and Tubing: In accordance with Section 15125 when specified on the drawings or approved by the AW Project Manager.

- C. Refer to the enclosed chart for acceptable service line materials.

Acceptable Service Line Materials and Application					
Material	3/4"	1"	1.5"	2"	Greater than 2"
Type "K" Copper	X	X	X	X	
HDPE DR 11	X	X	X	X	X
PVC SDR 21			X	X	
PVC C 900/905					X
Ductile Iron					X

- D. Corporation Main Stops: AWWA C 800 as modified in this Section:

1. Inlet End: AWWA standard thread.
2. Valve Body: Tapered plug type, O-ring seat ball type, or rubber seat ball type.
3. Outlet End: Flared-copper connection for use with Type K, soft copper or compression type fitting.

- E. Provide taps for water line types and sizes in accordance with pipe tapping schedule located in Table 1 at end of this Section.

- F. Dual Strap Saddles: Fusion epoxy coated saddles are acceptable as noted.

- G. Taps for PVC Watermains: Use dual-strap or single, wide-band strap saddles or Wet Tapping Sleeves which provide full support around circumference of pipe and bearing area of sufficient width along axis of pipe, 2 inches minimum, ensuring that pipe will not be distorted when saddle is tightened. Provide approved stainless-steel tapping saddle with AWWA standard thread.

- H. Taps for Steel Pipe: Not allowed, unless specifically approved by Project Manager. Use saddle only when tap is approved on steel pipe.

- I. Curb Stops and Brass Fittings: AWWA C 800 as modified in this Section.

1. Inlet End: Flared copper connection or compression-type fitting
2. Valve Body: Straight-through or angled, meter-stop design equipped with following:

- a. O-ring seal straight plug type.
- b. Rubber seat ball type.
3. Outlet End: Female, iron-pipe thread or swivel-nut, meter-spud thread on 3 ¼ -inch and finch stops and 2-hole flange on 1 ½ and 2-inch sizes.
4. Fittings: Provide approved fittings. Use same size open end wrenches and tapping machines as used with respective Mueller fittings.
5. Factory Testing of Brass Fittings:
  - a. Submerge in water for 10 seconds at 85 psi with stop in both closed and open positions.
  - b. Reject fitting that shows air leakage. AW Project Manager may confirm tests locally. Entire lot from which samples were taken will be rejected when random sampling discloses unsatisfactory fittings.
- J. Angle Stops: In accordance with AWWA C 800; ground-key, stop type with bronze lockwing head stop cap; inlet and outlet threads conform to application tables of AWWA C 800; and inlets flared connection or compression.
  1. Outlet for 3/4-inch and 1-inch size: Meter swivel nut with saddle support.
  2. Outlet for 1 ½ -inch through 2-inch size: O-ring sealed meter flange, iron pipe thread.
- L. Fittings: In accordance with AWWA C 800 and AWWA C901-02 and following:
  1. Castings: Smooth, free from burrs, scales, blisters, sand holes, and defects which would make them unfit for intended use.
  2. Nuts: Smooth cast and has symmetrical hexagonal wrench flats.
  3. Flare-Joint Fittings: Smooth cast. Machine seating surfaces for metal-to-metal seal to proper taper or curve, free from pits or protrusions.
  4. Thread fittings, of all types, shall have N.P.T. or AWWA threads, and protect male threaded ends in shipment by plastic coating, or approved equal.

5. Compression tube fittings shall have Buna-N beveled gasket.
6. Stamp of manufacturer's name or trademark and of fitting size on body.

## **PART 3 EXECUTION**

### **.01 GENERAL**

- A. For service lines and lateral connections larger than those allowed in Pipe Tapping Schedule, A Wet Cut shall be installed, 4" minimum size with an approved Tapping Valve and appurtenances included.
- B. Tapped collars of appropriate sizes: Approved in new construction only provided they are set at right angles to proposed meter location.
- C. Use tapping machine manufactured for pressure tapping purposes for 2-inch and smaller service taps on pressurized water lines.
- D. For new meter or when existing meter is in conflict with proposed pavement improvements, locate water meters one foot inside street right-of-way, or when this is not feasible, one foot on curb side of sidewalk. Contact Project Manager when major landscaping or trees conflict with service line and meter box location. No additional payment will be made for work on customer side of meter.
- E. New location and installation of existing small meter shall conform to requirements of this Section.

### **.02 SERVICE INSTALLATION**

- A. Set service taps at right angles to proposed meter location and locate taps in upper pipe segment within 45 degrees of pipe springline.
- B. Install service lines in open-cut trench in accordance with Section 02317 - Excavation and Backfill for Utilities. Install service lines under paved roadways, other paved areas and areas indicated on Drawings in bored hole.
- C. Lay service lines with minimum of 30 inches of cover as measured from top of curb or, in absence of curbs, from centerline elevation of crowned streets or roads. Provide minimum of 18 inches of cover below flow line of ditches to service lines.

- D. Service lines across existing street (push-unders): Pull service line through prepared hole under paving. Use only full lengths of tubing. Take care not to damage copper tubing when pulling it through hole. Compression-type union is only permitted when span underneath pavement cannot be accomplished with a full standard length of tubing. Use one compression-type union for each full length of tubing.
- E. Maintain service lines free of dirt and foreign matter.
- F. Install service lines so that top of meter will be 4 to 6 inches below finished grade.
- G. Anticipate existing sanitary sewers to have cement stabilized sand backfill to bottom of pavement. Include cost of such crossings in unit price for services.

### .03 CURB STOP INSTALLATION

- A. Set curb stops or angle stops at outer end of service line inside of meter box. Secure opening in curb stop to prevent unwanted material from entering. In close quarters, make S-curve in field. Do not flatten tube. In 3/4-inch and 1 -inch services, install meter coupling, swivel-nut, or curb stop ahead of meter. Install straight meter coupling on outlet end of meter.

### .04 SEQUENCE OF OPERATIONS

- A. Open trench for proposed service line in accordance with Section 02317 - Excavation and Backfill for Utilities.
- B. Install curb stop on meter end of service line.
- C. With curb stop open and prior to connecting service line to meter in slack position, open corporation stop and flush service line thoroughly. Close curb stop, leaving corporation stop in full-open position.
- D. Check service line for apparent leaks. Repair leaks before proceeding.
- E. Schedule inspection with AW Project Manager prior to backfilling. After inspection, backfill in accordance with Section 02317 - Excavation and Backfill for Utilities.
- F. Install meter box centered over meter with top of lid flush with finished grade.

**Table 1**

PIPE TAPPING SCHEDULE				
WATERMAIN TYPE AND DIAMETER	SERVICE SIZE			
	3/4"	1"	1-1/2"	2"
4" Cast Iron or Ductile Iron	DIRECT	DSS, WBSS	DSS, WBSS	DSS, WBSS
4" Asbestos Cement	WBSS	TS	TS	TS
4" PVC (AWWA C900)	DSS, WBSS	DSS, WBSS	DSS, WBSS	TS
6" and 8" Cast Iron or Ductile Iron	DIRECT	DSS, WBSS	DSS, WBSS	DSS, WBSS
6" and 8" Asbestos Cement	WBSS	TS	TS	TS
6" and 8" Cast Iron or Ductile Iron	DIRECT	DSS, WBSS	DSS, WBSS	DSS, WBSS
6" and 8" PVC (AWWA C900)	DSS, WBSS	DSS, WBSS	DSS, WBSS	TS
12" Cast Iron or Ductile Iron	DIRECT	DSS, WBSS	DSS, WBSS	DSS, WBSS
12" Asbestos Cement	WBSS	TS	TS	TS
12" PVC (AWWA C900)	DSS, WBSS	DSS, WBSS	DSS, WBSS	DSS, WBSS
16" and Up Cast Iron or Ductile Iron	DIRECT	DWBSS	DWBSS	DWBSS
16" and Up Asbestos Cement	DWBSS	TS	TS	TS
16" and Up PVC (AWWA C900)	DWBSS	DWBSS	DWBSS	DWBSS

DSS - DUAL STRAP SADDLES  
 WBSS- WIDE BAND STRAP SADDLES  
 DWBSS - DUAL WIDE BAND STRAP SADDLES  
 TS - TAPPING SLEEVE  
 DIRECT - DIRECT TAP INTO PIPE WALL

**END OF SECTION 15050**



## SECTION 15020

### DISINFECTING PIPELINES

#### PART 1 GENERAL

##### **.01 SCOPE OF WORK**

Flush and disinfect all pipelines installed under this Contract if indicated in the summary of work. This would include furnishing the necessary labor, tools, transportation, and other equipment for the operation of valves, hydrants, and blowoffs during the chlorination. Install, and if directed remove, all chlorination taps required for disinfection. The cost of this work shall be included in the bid item for pipe installation. The disinfection will be performed under the supervision of AW.

##### **.02 WORK BY OWNER**

AW reserves the option to provide/furnish the chlorine and chlorination equipment. AW will furnish water for testing, flushing and disinfecting pipelines. AW will also reserve the right to perform bacteriological testing and may collect the sample.

##### **.03 PROTECTION**

Chlorine disinfection and dechlorination shall be under the direct supervision of someone familiar with the physiological, chemical, and physical properties of the form of chlorine used. They shall be trained and equipped to handle any emergency that may arise. All personnel involved shall observe appropriate safety practices to protect working personnel and the public.

The forwards of AWWA Standards B300 and B301 contain information and additional reference material regarding the safe handling of hypochlorites and liquid chlorine. The Contractor shall familiarize himself with this information prior to performing any disinfection work.

##### **.04 RELATED WORK**

Observe the precautions described in Specification Section 15000 to avoid contamination during installation of the pipeline.



## **.05 REFERENCES**

Refer to current AWWA Standard for Disinfecting Water Mains C651.

## **PART 2 PRODUCTS**

### **.01 MATERIALS AND EQUIPMENT**

- A. Furnish liquid chlorine and injection equipment and/or calcium hypochlorite (HTH) as needed to disinfect all pipelines and appurtenances.
- B. Liquid chlorine contains 100% available chlorine and is packaged in steel containers, usually of 100 lb, 150 lb, or 1 ton net chlorine weight. Liquid chlorine is to be furnished in accordance with AWWA B301.
- C. Calcium hypochlorite is available in granular form or in approximately 5-g tablets, and contains approximately 65% available chlorine by weight. The material should be stored in a cool, dry, and dark environment to minimize its deterioration. Do not use calcium hypochlorite intended for swimming pool disinfection, as this material (containing trichloroisocyanuric acid) has been sequestered and is extremely difficult to eliminate from the pipe after the desired contact time had been achieved.
- D. Calcium hypochlorite must conform to AWWA B300.

## **PART 3 EXECUTION**

### **.01 PREPARATION**

All pipelines shall be pressure and leak tested, flushed, and cleaned of debris and dirt prior to application of the disinfectant. Flushing shall continue until the volume in the newly installed main has turned over at least one time unless AW determines that conditions do not permit the required volume to be safely discharged to waste.





## **.02 APPLICATION OF DISINFECTANT**

Methods to be used for disinfection are those detailed in ANSI/AWWA C651 Disinfecting Water Mains.

## **.03 WATER MAINS**

Three (3) methods of chlorination are described below. The third method, using tablets of hypochlorite, is only permitted by expressed approval of AW and under no circumstance allowed for projects of 2000 feet or more. Otherwise, information in the forward of AWWA Standard C651 will be helpful in determining the best method to be used.

### **A. Continuous Feed Method**

#### **1. Set up**

The continuous feed method consists of completely filling the main to remove all air pockets, flushing the completed main to remove particulates, and then refilling the main with chlorinated potable water. The potable water shall be chlorinated, so that after a 24-hour holding period in the main, there will be a free chlorine residual of not less than 10 mg/L in collected samples.

Chlorine can be applied in advance of preliminary flushing by swabbing joints with bleach or placing hypochlorite granules in the pipe in areas where contamination is suspected. In any such case, the contractor shall make sure and take appropriate action to make sure that the flushed water is dechlorinated.

Preliminary flushing. Prior to being chlorinated, fill the main to eliminate air pockets and flush to remove particulates. The flushing velocity in the main shall be not less than 2.5 fps unless the Engineer determines that conditions do not permit the required flow to be discharged to waste. Table 1 shows the rates of flow required to produce a velocity of 2.5 fps in pipes of various sizes.

NOTE: Flushing is no substitute for preventive measures during construction. Certain contaminants such as caked deposits resist flushing at any feasible velocity.



**TABLE 1**  
Required Flow and Openings to Flush Pipelines  
(40 psi Residual Pressure in Water Main)\*

Pipe Diameter (inches)	Flow required to produce 2.5 fps velocity in main (gpm)	Size of Tap. (inches)			Number of Hydrant Outlets To Use
		1	1-1/2	2	
		<u>Number of taps on Pipe<sup>†</sup></u>			
4	100	1	-	-	1
6	200	-	1	-	1
8	400	-	2	1	1
10	600	-	3	2	1
12	900	-	-	2	2
16	1600	-	-	4	2

\*With a 40 psi pressure in the main with the hydrant flowing to atmosphere, a 2½-inch hydrant outlet will discharge approximately 1,000 gpm and a 4½-inch hydrant outlet will discharge approximately 2,500 gpm.

† Number of taps on pipe based on discharging through 5 feet of galvanized iron pipe with one 90 degree elbow.

In mains of 24-inches or larger diameter, an acceptable alternative to flushing is to broom-sweep the main, carefully removing all sweepings prior to chlorinating the main.

## 2. Chlorinating the Main.

- a. Flow water from the existing distribution system or other approved source of supply at a constant, measured rate into the newly laid water main. In the absence of a meter, approximate the rate by placing a pitot gauge in the discharge or measuring the time to fill a container of known volume.
- b. At a point not more than 10 feet downstream from the beginning of the new main, dose the water entering the new main with chlorine fed at a constant rate such that



the water will have not less than 25 mg/L free chlorine. Measure the chlorine concentration at regular intervals to ensure that this concentration is provided. Measure chlorine in accordance with the procedures described in the current edition of the AWWA Manual M12 or of *Standard Methods for the Examination of Water and Wastewater*.

- c. Table 2 gives the amount of chlorine required for each 100 feet of pipe of various diameters. Solutions of 1 percent chlorine may be prepared with calcium hypochlorite. The solution requires 1 pound of calcium hypochlorite in 8 gallons of water.

**TABLE 2**  
 Chlorine Required to Produce 25 mg/L  
 Concentration in 100 feet of Pipe by Diameter

Pipe Diameter inches	100 Percent Chlorine lbs	1 Percent Chlorine Solutions gallons
4	0.013	0.16
6	0.030	0.36
8	0.054	0.65
10	0.085	1.02
12	0.120	1.44
16	0.217	2.60

- d. During the application of chlorine, position valves so that the strong chlorine solution in the main being treated will not flow into water mains in active service. Do not stop the chlorine application until the entire main is filled with heavily chlorinated water. Keep the chlorinated water in the main for at least 24 hours. During this time, operate all valves and hydrants in the section treated in order to disinfect the appurtenances. At the end of this 24-hour period, the treated water in all portions of the main shall have a residual of not less than 10 mg/L free chlorine.
- e. Hypochlorite solution may be applied to the water main with a gasoline or electrically powered chemical



feed pump designed for feeding chlorine solutions. Feed lines shall be of such material and strength as to safely withstand the corrosion caused by the concentrated chlorine solutions and the maximum pressures that may be created by the pumps. Check all connections shall for tightness before the solution is applied to the main.

- f. If gaseous chlorine in solution is permitted by the Engineer and proposed by the contractor, the preferred equipment for the gas application employs a feed vacuum-operated chlorinator to mix the chlorine gas, in combination with a booster pump for injecting the chlorine gas solution water into the main to be disinfected. Direct feed chlorinators cannot be used. (A direct feed chlorinator is one which operates solely from the pressure in the chlorine cylinder.)

## B. Slug Method

### 1. Setup

- a. The slug method consists of placing calcium hypochlorite granules in the main during construction; completely filling the main to eliminate all air pockets, flushing the main to remove particulates, and slowly flowing a slug of water containing 100 mg/L of free chlorine through the main so that all parts of the main and its appurtenances will be exposed to the highly chlorinated water for a period of not less than 3 hours.

### 2. Chlorinating the main.

- a. At the option of AW, place calcium hypochlorite granules in the main during construction. The purpose of this procedure is to provide a strong chlorine concentration in the first flow of flushing water especially to fill annular spaces in pipe joints. Flush the main to eliminate air and remove particulates to include management of dechlorination and discharged water.



- b. At a point not more than 10 feet downstream from the beginning of the new main, dose the water entering the new main with chlorine fed at a constant rate such that the water will have not less than 100 mg/L free chlorine. Measure the chlorine concentration at regular intervals to ensure that this concentration is provided. Measure chlorine in accordance with the procedures described in the current edition of the AWWA Manual M12 or of *Standard Methods for the Examination of Water and Wastewater*. The chlorine shall be applied continuously and for a sufficient period to develop a solid column or "slug" of chlorinated water that will, as it moves through the main, expose all interior surfaces to a concentration of approximately 100 mg/L for at least 3 hours.
- c. The free chlorine residual shall be measured in the slug as it moves through the main. If at any time it drops below 50 mg/L, stop the flow, relocate the chlorination equipment to the head of the slug, and as flow is resumed, apply chlorine to restore the free chlorine in the slug to not less than 100 mg/L.
- d. As the chlorinated water flows past fittings and valves, operate related valves and hydrants so as to disinfect appurtenances and pipe branches.

#### C. Tablet Method

##### 1. Setup

- a. The tablet method consists of adhering calcium tablets in the water main as it is being installed and then filling the main with potable water when installation is completed. This method may be used only if the pipes and appurtenances are kept clean and dry during construction and with permission by AW for short main installations.

##### 2. Chlorinating the Main –

- a. Placing of calcium hypochlorite tablets - *Placing of calcium hypochlorite tablets*. During construction, 5-g calcium hypochlorite tablets shall be placed in each



section of pipe. Also, one such tablet shall be placed in each hydrant, hydrant branch, and other appurtenance. The number of 5-g tablets required for each pipe section shall be  $0.0012 d^2 L$  rounded to the next higher integer, where  $d$  is the inside pipe diameter, in inches, and  $L$  is the length of the pipe section, in feet. Table 1 shows the number of tablets required for commonly used sizes of pipe. The tablets shall be attached by a food-grade NSF approved adhesive. There shall be no adhesive on the tablet except on the broadside attached to the surface of the pipe and no adhesive applied or spilled on the pipe surface. Excess adhesive must be removed immediately using mechanical means or an NSF approved adhesive solvent. Attach all the tablets inside and at the top of the main, with approximately equal numbers of tablets at each end of a given pipe length. If the tablets are attached before the pipe section is placed in the trench, their position shall be marked on the section so it can be readily determined that the pipe is installed with the tablets at the top.

		Length of Pipe Section, ft (m)				
Pipe Diameter		13(4.0) or less	18(5.5)	20(6.1)	30(9.1)	40(12.2)
<i>in.</i>	<i>(mm)</i>	Number of 5-g Calcium Hypochlorite Tablets				
6	(150)	1	1	1	2	2
8	(200)	1	2	2	3	4
12	(300)	3	4	4	6	7
16	(400)	4	6	7	10	13

- b. *Filling and contact.* When installation has been completed, the main shall be filled with water at a rate such that water within the main will flow at a velocity no greater than 1 ft/s (0.3 m/s). Precautions shall be taken to ensure that air pockets are eliminated. This water shall



remain in the pipe for at least 24 hours. If the water temperature is less than 41°F (5°C), the water shall remain in the pipe for at least 48 hours.

#### **.04 DISPOSAL OF HEAVILY CHLORINATED WATER**

- A. Do not keep heavily chlorinated water in contact with pipe for more than 48 hours after the applicable retention period. In order to prevent damage to the pipe lining or corrosion damage to the pipe itself, flush the heavily chlorinated water from the main fittings, valves, and branches until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the system or is acceptable for domestic use. Take all steps necessary to dechlorinate water where required per section 3.04B and 3.04C below. Contact the local sewer department to arrange for disposal of the heavily chlorinated water to the sanitary sewer if applicable.
- B. Neutralize the chlorine residual of the water being disposed of by treating with one of the chemicals listed in Table 3. Select an alternative disposal site if a sanitary sewer system is unavailable for disposal of the chlorinated water.
- C. The proposed alternative disposal site shall be inspected and approved of by AW. Apply a reducing agent to the chlorinated water to be wasted to completely neutralize the chlorine residual remaining in the water. (See Table 3 for neutralizing chemicals. Do not overdose neutralizing chemicals as this may result in adverse environmental impacts. Only dose the amount required to neutralize the amount of chlorine present). Contact federal, state and local regulatory agencies, where necessary, to determine special provisions for the disposal of heavily chlorinated water.

**Table 3**

Pounds of chemicals required to neutralize various residual chlorine concentrations in 100,000 gallons of water.

Residual Chlorine Concentration	Sulfur Dioxide	Sodium Bisulfite	Sodium Sulfite	Sodium Thiosulfate	Ascorbic Acid
<u>mg/L</u>	<u>(SO<sub>2</sub>)</u>	<u>(NaHSO<sub>3</sub>)</u>	<u>(Na<sub>2</sub>SO<sub>3</sub>)</u>	<u>(Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> · 5H<sub>2</sub>O)</u>	
1	0.8	1.2	1.4	1.2	2.1
2	1.7	2.5	2.9	2.4	4.2
10	8.3	12.5	14.6	12.0	20.9
50	41.7	62.6	73.0	60.0	104.0

- D. Test for chlorine residual throughout the disposal process to be sure that the chlorine is neutralized
- E. Submit a plan of disposal of flushed water to AW for approval

## **.05 BACTERIOLOGICAL TESTING**

- A. After final flushing and before the water main is placed in service, the first of two consecutive sets of acceptable samples can be collected from the new main. The second set of samples must be taken at least 24 hours after the first set of samples. The main should not be flushed between collection of the first and second set of samples except to clear the sample site to collect the second sample. At least one set of samples shall be collected from every 1,200 feet, of the new water main, plus one set from the end of the line and at least one set from each branch when possible or as required by regulatory requirements.
- B. Samples shall be collected by a person knowledgeable in collecting samples for bacteriological sampling or arrange for the Owner to collect the sample. Coordinate with Owner and submit samples to the Owner for testing of bacteriological (chemical and physical) quality. Testing will be in accordance with Standard Methods of the Examination of Water and Wastewater. Samples shall show the absence of coliform





organisms; and the presence of a chlorine residual. Samples shall also be tested for turbidity, pH, and standard heterotrophic plate count (HPC). HPC levels must be consistent with levels normally found in the distribution system to which the new main is connected.

- C. Bacteriological tests must show complete absence of coliforms and acceptable HPCs. If tests show the presence of coliform or unacceptable HPCs, perform additional flushing and disinfection of the pipeline until acceptable tests are obtained, all at no cost to the Owner. The Contractor will not be charged for the additional testing performed by the Owner.

**.06****RETESTING AND TESTING SOURCE WATER**

- A. At the time of initial flushing the main to remove material and test for air pockets, Contractor may request AW to continue flushing until the desired chlorine residual is met at the discharge point. Notification must be provided in advance and the Contractor shall be prepared to test for chlorine at intervals of no more than five minutes as the water clears. This will provide the Contractor with some assurance that the source water is chlorinated.
- B. If the subsequent tests for bacteriological contamination conducted by the Contractor fail, the Contractor may request the Owner to continue flush from the source water into the new pipe system until a chlorine residual is found at the discharge point. Notification must be provided in advance and the Contractor shall be prepared to test for chlorine at intervals of no more than five minutes as the water clears. The operation of all existing system valves shall be by the Owner at the Contractor expense and the discharge point must be opened prior to opening existing valves to avoid contamination. This will provide the Contractor with some assurance that the source water is chlorinated for subsequent tests.

**END OF SECTION 15020**

**SECTION 15105****DUCTILE IRON PIPE AND FITTINGS****PART 1 GENERAL****.01 COORDINATION OF WORK**

Connection to existing pipelines may require shutdown of Owner facilities. Closely coordinate construction work and connections with the Owner through the Engineer. The Engineer, in consultation with the Owner, may select the time for connection to existing pipelines, including Saturdays, Sundays, or holidays, which, in the opinion of the Engineer, will cause the least inconvenience to the Owner and/or its customers. Make such connections at such times as may be directed by the Owner, at the Contract prices, with no claim for premium time or additional costs.

**.02 RELATED WORK**

Piping - General Provisions - Specification Section 15000

**.03 SUBMITTALS**

Submit shop drawings and manufacturer's literature for all Contractor supplied materials promptly to the Engineer for approval in accordance with Specification Section 1300.

**PART 2 PRODUCTS**

Research has documented that certain elastomers (such as those used in gasket material) may be subject to permeation by lower-molecular weight organic solvents or petroleum products. Products supplied under this Specification Section assume that petroleum products or organic solvents will not be encountered. If during the course of pipeline installation the Contractor identifies, or suspects the presence of petroleum products or any unknown chemical substance, notify AW immediately. Stop installing piping in the area of suspected contamination until direction is provided by AW.

**.01 PIPE MATERIAL****A. General**

Ductile iron pipe shall conform to the latest specifications as adopted by the American National Standards Institute, Inc., (ANSI) and the American Water

Works Association (AWWA). Specifically, ductile iron pipe shall conform to AWWA Standard C151.

The pipe or fitting exterior shall be coated with a bituminous coating in accordance with AWWA Standard C151. The pipe or fitting interior shall be cement mortar lined and seal coated in compliance with the latest revision of AWWA Standard C104.

B. Quality

Pipe and fittings shall meet the following minimum quality requirements by conforming to the following:

1. AWWA C105 / ANSI A21.5 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water Polyethylene Encasement for Ductile-Iron Pipe Systems
2. AWWA C110 / ANSI A21.10 Ductile Iron and Gray Iron Fittings, 3 NPS through 48 NPS for Water AWWA C111 / ANSI A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
3. AWWA C115 / ANSI A21.15 Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
4. AWWA C116 / ANSI A21.16 Protective Fusion-Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service
5. AWWA C150 / ANSI A21.50 Thickness Design of Ductile-Iron Pipe
6. AWWA C151 / ANSI A21.51 Ductile-Iron Pipe, Centrifugally Cast, for Water
7. AWWA C153 / ANSI A21.53 Ductile-Iron Compact Fittings, 3 NPS through 24 NPS and 54 NPS through 64 NPS, for Water Service

Ductile iron water pipe and fittings will be accepted on the basis of the Manufacturer's certification that the material conforms to this specification. The certification for iron fittings shall list a fitting description, quantity, bare fitting weight and source, (AWWA Standard C110, C153 or Manufacturer, if fitting is not listed in either standard). The certification shall accompany the material delivered to the project site. The Owner reserves the right to sample and test this material subsequent to delivery at the project site. If foreign manufactured fittings are provided, then the Contractor is obligated to notify AW with a submittal and provide the necessary documentation to satisfy the AW that the materials provided meet the specified AWWA standards and, among other documentation that may be required, provide certificates of compliance on the component supplied.

### C. Pipe Class

The pressure class of pipe to be furnished shall be in accordance with Table 1 and the notes listed below.

Table 1  
**MINIMUM RATED WORKING PRESSURE**  
**FOR DUCTILE IRON PIPE MANUFACTURED IN ACCORDANCE**  
**WITH AWWA Standard C151**

<u>Pipe Size (Inch)</u>	<u>Pressure Class</u>
6	350
8	350
12	350
16	300
20	300
24	250

#### NOTES:

1. Larger pipe sizes up to 54-inch can be installed as pressure Class 200 with cover up to nine (9) feet and an operating pressure of 200 psi, where approved by the Engineer. When trench depths exceed fifteen (15) feet for pipe sizes of 16-inch or larger, AW shall direct the Contractor on the proper class pipe to use.
2. The noted pressure class is adequate to support 3/4 and 1-inch corporation stops. Use a full saddle for larger taps (e.g., air relief valves or larger corporations) due to limited wall thickness.
3. There are special conditions where a larger wall thickness is required. AW shall direct the Contractor on the proper pressure class pipe to use in specific instances; e.g. at treatment plant or booster station sites where frequent excavation can be anticipated in the vicinity of pipe, where the pipeline is laid on a river channel bottom to prevent external damage to the pipe and minimize the potential for costly pipe replacement, etc.

### D. Testing

Perform a hydrostatic test of all pipe and appurtenances as required by AWWA Standard C151 and Specification Section 15030.

## E. Joints

### 1. Mechanical and Push-On

Mechanical and push-on joints including accessories shall conform to AWWA Standard C111.

### 2. Flanged

Flanged joints shall conform to AWWA Standard C110 or ANSI B16.1 for fittings and AWWA Standard C115 for pipe. Do not use flanged joints in underground installations except within structures.

Furnish all flanged joints with 1/8-inch thick, red rubber or styrene butadiene rubber gaskets. The bolts shall have American Standard heavy unfinished hexagonal head and nut dimensions all as specified in American Standard for Wrench Head Bolts and Nuts and Wrench Openings (ANSI B18.2). For bolts of 1-3/4-inches in diameter and larger, bolt studs with a nut on each end are recommended. The high-strength, low-alloy steel for bolts and nuts shall have the characteristics listed in Table 6 of AWWA Standard C111.

### 3. Restrained Joint Pipe

Restrained joints for pipes shall be of the boltless push-on type which provides joint restraint independent of the joint seal. Restrained push-on joints allowed for pipe only shall have accessories conforming to AWWA Standard C111. Restrained system shall be suitable for the following minimum working pressures:

<u>Size (Inch)</u>	<u>Pressure (psi)</u>
Less than 20"	350
20"	300
24"	250
30" - 64"	200

## **.02 FITTINGS**

### A. Ductile Iron Fittings

Standard fittings shall be ductile iron conforming to AWWA Standard C110. Compact ductile iron fittings shall meet the requirements of AWWA Standard C153.

## 1. Working Pressures

Fittings shall be suitable for the following working pressures unless otherwise noted in AWWA Standard C110 or C153:

<u>Size</u>	<u>Pressure (psi)</u>	
	<u>Compact Fittings Ductile Iron</u>	<u>Standard Fittings Ductile Iron</u>
3" - 24"	350	250, 350 (with special gaskets)
30" - 48"	250	250
54" - 64"	150	N/A

The use of standard ductile iron fittings having a 250 psi pressure rating with ductile iron pipe (having a rating of 350 psi) is not permitted except by the expressed written approval by AW.

## 2. Coating and Lining

The fittings shall be coated on the outside with a petroleum asphaltic coating in accordance with AWWA Standard C110 or fusion coated epoxy in accordance with AWWA Standard C116 and lined inside with cement-mortar and seal coated in accordance with AWWA Standard C104 or fusion coated epoxy in accordance with AWWA Standard C116.

## B. Joints

### 1. Mechanical and Push-On

Mechanical and push-on joints including accessories shall conform to AWWA Standard C111. Anti-Rotation I T-Bolts shall be used on mechanical joints shall be of domestic origin, high strength, low alloy steel bolts only, meeting the current provisions of American National Standard ANSI/AWWA C111/A21.1-90 for rubber gasket joints for cast iron or ductile iron pipe and fittings. Bolt manufacturer's certification of compliance must accompany each shipment. T-bolts shall corrosion resistant to handle corrosive conditions on any buried bolts.

### 2. Flanged

Flanged joints shall meet the requirements of AWWA Standard C115 or ANSI B16.1. Do not use flanged joints in underground installations except within structures. Furnish all flanged joints with a minimum

1/8-inch, thick red rubber or styrene butadiene rubber gasket. The bolts shall have American Standard heavy unfinished hexagonal head and nut dimensions all as specified in ANSI B18.2. Xylan or FluoroKote #1 Hex Bolts (corrosion resistant) to handle corrosive conditions shall be used on any buried flanged bolts. Flange gaskets shall be rubber in composition; paper gaskets are not permitted.

Bolts and nuts shall be threaded in accordance with ASME/ANSI B1.1, Unified Inch Screw Threads (UN and UNR Thread Form) class 2A external and class 2B internal. For bolts of 1-3/4-inches in diameter and larger, bolt studs with a nut on each end are recommended. Material for bolts and nuts shall conform to ASTM A307, 60,000 PSI Tensile Strength, Grade B, unless otherwise specified. Bolt manufacturer's certification of compliance must accompany each shipment.

### 3. Restrained

Restrained joints for valves and fittings shall be of the boltless push-on type which provides joint restraint independent of the joint seal. Field Lok gaskets are not permitted on valves or fittings. Restrained push-on joints allowed for pipe only shall have accessories conforming to AWWA Standard C111. Restrained system shall be suitable for the following minimum working pressures:

<u>Size</u>	<u>Pressure (psi)</u>
Less than 20"	350
20"	300
24"	250
30" - 64"	250

Where adjacent fittings are to be placed (as in a mechanical joint hydrant tee and a mechanical joint hydrant valve), the use of a suitably sized Foster adaptor is permitted to facilitate restraint between the fittings.

## PART 3 EXECUTION

### .01 INSTALLATION

Follow the provisions of Specification Section 15000 in addition to the following requirements:



### A. Push-On Joints

Clean the surfaces that the gasket will contact thoroughly, just prior to assembly using a bacteria free solution (bleach, potable water or NSF approved material). Insert the gasket into the groove in the bell. Apply a liberal coating of special lubricant to the gasket and the spigot end of the pipe before assembling the joint. Center the spigot end in the bell and push home the spigot end.

### B. Mechanical Joints

Clean and lubricate all components with soapy water prior to assembly. Slip the follower gland and gasket over the pipe plain end making sure that the small side of the gasket and lip of the gland face the bell socket. Insert the plain end into socket. Push gasket into position with fingers. Seat gasket evenly. Slide gland into position, insert bolts, and tighten nuts by hand. Tighten bolts alternately (across from one another) to the recommended manufacturing rating or if not provided, to the following normal torques:

<u>Bolt Size</u>	<u>Range of Torque In Foot-Pounds</u>
5/8"	40 - 60
3/4"	60 - 90
1"	70 - 100
1-1/4"	90 - 120

After field installation, all bolts shall receive petrolatum tape or petroleum wax protection or other approved coating material. Protection shall be applied before applying polywrap per specification 15130.

### C. Restrained Joints

#### 1. Ball and Socket

Assemble and install the ball and socket joint according to the manufacturer's recommendations. Thoroughly clean and lubricate the joint. Check the retainer ring fastener.

#### 2. Push-On

Assemble and install the push-on joint according to the manufacturer's recommendations. Thoroughly clean and lubricate the joint. Check the retainer ring fastener.



Protect pipe from damage from the jacking device (backhoe bucket, pipe jack, etc.) when “pushing home” any pipe by using wood or other suitable (non metallic) material.

(3) Mechanical Joint

Assemble and install the mechanical joint according to the manufacturer's recommendations. Thoroughly clean and lubricate the joint. Use approved restrained joint device on fittings and valves where required and approved for use by AW.

D. Pipe Protection

Protect pipe from damage from the jacking device (backhoe bucket, pipe jack, etc.) when “pushing home” any pipe. Wood or other suitable material (non metallic) shall be used to push home the pipe.

E. Gaskets

Gaskets shall be as provided or recommended by the manufacturer and satisfy AWWA standard C111 in all respects. As noted in the products section of this specification, some gasket materials are prone to permeation of certain hydrocarbons which may exist in the soil (see part 2). Under these conditions and at AW'S discretion require contractor to provide FKM (Viton, Flourel) gasket material in areas of concern.

**END OF SECTION 15105**

## SECTION 15120

### POLYVINYL CHLORIDE (PVC) PIPE

#### PART 1 GENERAL

##### .01 SECTION INCLUDES

PVC pressure pipe and fabricated fittings in nominal sizes 4 inches through 12 inches with cast iron pipe equivalent outside diameters.

##### .02 SUBMITTALS

Submit manufacturer's product data, installation instructions and certification for all materials to be furnished in accordance with Specification Section 1300. Submit classification and gradation test results for embedment and pipe backfill material.

#### PART 2 PRODUCTS

Research has documented that certain pipe materials (such as polyvinyl chloride, polyethylene, and polybutylene) and certain elastomers (such as those used in gasket material) may be subject to permeation by lower-molecular weight organic solvents or petroleum products. Products supplied under this Specification Section assume that petroleum products or organic solvents will not be encountered. If during the course of pipeline installation the Contractor identifies, or suspects the presence of petroleum products or any unknown chemical substance, notify AW immediately. Stop installing piping in the area of suspected contamination until direction is provided by the Engineer.

##### .01 PIPE MATERIALS – WATER DISTRIBUTION

All PVC pipe shall be PVC 1120 pressure pipe made from class 12454 material as defined by ASTM D-1784 with outside diameter dimensions of steel or cast iron pipe. The PVC compounds shall be treated or certified suitable for potable water products by the National Sanitation Foundation (NSF) Testing Laboratory (NSF Standard No. 61).

PVC Pipe 4 inch through 12 inch:

AWWA Standard C900, DR14 and where permitted DR18. DR25 pipe will not be allowed. PVC pipe has recently been upgraded by pressure class, however American Water does not allow pipe in its system to be

fully subject to the revised pressures in AWWA C900. DR14 shall not be subjected to pressures exceeding 250 psi. DR18 shall not be subjected to pressures exceeding 200 psi.

## .02 GRAVITY SEWER PIPE

- A. PVC gravity sanitary sewer pipe and storm sewer pipe shall be in accordance with provisions in following table except where specified differently on the drawings:

WALL CONSTRUCTION	MANUFACTURER	ASTM DESIGNATION	SDR (Max) STIFFNESS (MIN.)	DIAMETER SIZE RANGE
Solid	7-M Pipe CertainTeed Diamond Uponor ETI North American	D3034	SDR 26 IPS	6" to 10"
		D3034	SDR 35 IPS	12" & 15"
		F679	SDR 35 IPS	18" to 27"
		AWWA C900	DR 18 /NIA	4" to 12"
		AWWA C909	DR 181 NIA	4" to 12"
		AWWA C905	DR 18 /NIA	14" to 16"
Truss (Gasketed)	Contech	D2680	N/A /200 psi	8" to 15"
Profile	Contech A-2000	F949	N/A 146 psi	12" to 36"
	Contech A-2026	F949	N/A 1115 psi	8" to 10"
	ETI, Ultra-Rib	F794	N/A 146 psi	5" to 30"
	ETI, Ultra-Cory	F794	N/A 146 psi	24" to 36"

- B. When solid wall PVC pipe 18 inches to 27 inches in diameter is required in SDR 26, provide pipe conforming to ASTM F 679, except provide wall thickness as required for SDR 26 and pipe strength of 115 psi.
- C. For sewers up to 12-inch diameter crossing over water lines, or crossing under water lines with less than 2-feet separation, provide minimum 150 psi pressure rated pipe conforming to ASTM D 2241 with suitable PVC adapter couplings.

- D. Joints: Spigot and integral wall section bell with solid cross section elastomeric or rubber ring gasket conforming to requirements of ASTM D 3212 and ASTM F 477, or ASTM D 3139 and ASTM F 477. Gaskets shall be factory-assembled and securely bonded in place to prevent displacement. Manufacturer shall test sample from each batch conforming to requirements ASTM D 2444
- E. Fittings: Provide PVC gravity sewer sanitary bends, tee, or wye fittings for new sanitary sewer construction. PVC pipe fittings shall be full-bodied, either injection molded or factory fabricated. Saddle-type tee or wye fittings are not acceptable.
- F. Conditioning. Conditioning of samples prior to and during tests is subject to approval by AW Project Manager. When referee tests are required, condition specimens in accordance with Procedure A in ASTM D 618 at 73.4 degrees F plus or minus 3.6 degrees F and 50 percent relative humidity plus or minus 5 percent relative humidity for not less than 40 hours prior to test. Conduct tests under same conditions of temperature and humidity unless otherwise specified.
- G. Pipe Stiffness. Determine pipe stiffness at 5 percent deflection in accordance with Test Method D 2412. Minimum pipe stiffness shall be 46 psi. For diameters 4 inches through 18 inches, test three specimens, each a minimum of 6 inches (150 mm) in length. For diameters 21 inch through 36 inch, test three specimens, each a minimum of 12 inch (300 mm) in length.
- H. Flattening. Flatten three specimens of pipe, prepared in accordance with Paragraph 2.04F, in suitable press until internal diameter has been reduced to 60 percent of original inside diameter of pipe. Rate of loading shall be uniform. Test specimens, when examined under normal light and with unaided eye, shall show no evidence of splitting, cracking, breaking, or separation of pipe walls or bracing profiles. Perform the flattening test in conjunction with pipe stiffness test.
- I. Joint Tightness. Test for joint tightness in accordance with ASTM D 3212, except that joint shall remain watertight at minimum deflection of 5 percent. Manufacturer will be required to provide independent third party certification for joint testing each diameter of storm sewer pipe.
- J. Purpose of Tests. Flattening and pipe stiffness tests are intended to be routine quality control tests. Joint tightness test is intended to qualify pipe to specified level of performance.

### .03 SANITARY SEWER FORCE MAIN PIPE

- A. Provide approved PVC pressure pipe conforming to requirements for water service pipe, and conforming to minimum working pressure rating specified in Section 15210 - Sanitary Sewer Force Mains.
- B. Acceptable pipe joints are integral bell-and-spigot, containing a bonded-in elastomeric sealing ring meeting requirements of ASTM F 477. In designated areas requiring restrained joint pipe and fittings, use approved joint restraint device conforming to UNI-B-13, for PVC pipe 12-inch diameter and less.
- C. Fittings: Provide approved ductile iron fittings as per Section 15105 - Ductile Iron Pipe and Fittings, except furnish fittings with one of following approved internal linings:
  - 1. Nominal 40 mils (35 mils minimum) virgin polyethylene complying with ASTM D 1248, heat fused to interior surface of fitting
  - 2. Nominal 40 mils (35 mils minimum) polyurethane
  - 3. Nominal 40 mils (35 mils minimum) ceramic epoxy
  - 4. Nominal 40 mils (35 mils minimum) fusion bonded epoxy
- D. Exterior Protection: Provide polyethylene wrapping of ductile-iron fittings as required by Section 15130 - Polyethylene Wrap.
- E. Hydrostatic Tests: Hydrostatically test pressure rated pipe in accordance with Specifications.

### .04 RECEIVING, HANDLING AND STORAGE

- A. Inspect pipe and appurtenances for defects prior to installation in the trench. Set aside and clearly mark defective, damaged or unsound material and hold material for inspection by AW.
- B. Load and unload all materials in accordance with the manufacturer's recommendations and in such a manner as to prevent damage. Do not drop pipe and accessories or handle them in a rough manner.
- C. Provide safe storage for all materials. Cover stored pipe that will be exposed to sunlight for periods longer than 6 months. Cover with canvas or other opaque material with provision for adequate air circulation. PVC pipe shall not be stored close to heat sources, such as heaters, boilers, steam lines, or engine exhaust.

## PART 3 EXECUTION

### .01 INSTALLATION

Follow the provisions of Specification Section 15000, 15200, and 15210 in addition to the following requirements:

- A. Remove all dirt and foreign matter from pipe before lowering it into the trench. Do not place debris, hand tools, clothing or other materials in the pipe. Keep pipe clean during and after laying.
- B. Lay pipe with the bell end pointing in the direction of work progress. Do not roll, drop or dump pipe or appurtenances into the trench.
- C. Assemble push-on joints in accordance with the pipe manufacturer's recommendations. Assemble mechanical joints in accordance with the fitting manufacturer's recommendations.
- D. Cut pipe with pipe saws, circular saws, handsaws, or similar equipment. Provide a smooth end at a right angle to the longitudinal axis of the pipe. Deburr, bevel, and re-mark insertion line on spigot ends. Match factory bevel length and angle for field bevels. When connecting to certain shallow depth bells, such as those on some cast iron fittings and valves, cut off the factory bevel and prepare a deburred, square cut end with a slight outer bevel.
- E. Clean the sealing surface of the spigot end, the pipe bell, the coupler or fitting, and the elastomeric gaskets immediately before assembly. Do not remove factory installed gaskets for cleaning. Keep the joint free of dirt, sand, grit, grease or any foreign material. Apply approved lubricant when assembling gasketed joints in accordance with the pipe manufacturer's requirements. The use of improper lubricants can damage gaskets. Excessive lubricant use can make disinfection more difficult and cause taste and odor problems when the line is placed in service.
- F. Good pipe alignment is essential for proper joint assembly. Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly. Do not swing or "stab" the joint; that is, do not suspend the pipe and swing it into the bell. The spigot end of the pipe is marked by the manufacturer to indicate the proper depth of insertion. Avoid metal to plastic contact with the pushing the pipe home (use wood or other material to cushion moving the pipe. Neither deflection or bending of PVC pipe joints are permitted.
- G. Assemble pipe using the following types of joints:

1. Gasketed bell joint – Integral with the pipe or fitting
2. Gasketed coupling – A double gasketed coupling
3. Mechanical joint – Any of the several joint designs that have gaskets and bolts manufactured in accordance with AWWA standards.

#### H. Tracer Wire

1. Place tracer wire in accordance with Specification 02558.
2. The wire shall be contiguous except at test stations, valve boxes, and where splicing is required. All splices shall be encased with a 3M-Gel Pack Model No. 054007-09053, or approved equal.

#### I. Pressure testing of DR 14 PVC pipe should not exceed 275 psi. Pressure testing of DR 18 PVC pipe should not exceed 200 psi if approved for use.

#### J. PVC pipe fittings shall employ ductile iron pipe fittings per specifications 15105. See detail drawings for transitions between different pipe materials.

#### K. Gaskets - Gaskets shall be as provided or recommended by the manufacturer and satisfy AWWA standard C111 in all respects. Where ductile iron pipe and PVC pipe are directly connected, the appropriate gasket material for this purpose shall be employed. As noted in the products section of this specification, some gasket materials are prone to permeation of certain hydrocarbons which may exist in the soil (see part 2). Under these conditions and at the Engineer's discretion require contractor to provide FKM (Viton, Flourel) gasket material in areas of concern.

### .02 SERVICE CONNECTIONS

#### A. Install service connections in accordance with AWWA Standard C605 and the manufacturer's recommendations using the following methods:

Install service connections in accordance with AWWA Standard C605 and the manufacturer's recommendations using the following methods:

1. Tapping is only permitted through the use of service clamps or saddles.
2. Using injection molded couplings with threaded outlets.

3. Tapping with large service connections through appropriately sized tapping sleeves and valves.
4. Direct tapping of 1 inch and smaller service connections is not permitted. Use service saddles only for AWWA Standard C900 pipe, for nominal pipe sizes 6 inch through 12 inch. Corporation stops shall be threaded and conform to AWWA Standard C800.
5. The distance between the PVC pipe joint and a service tap (2" and smaller) shall be a minimum of 3 feet. The distance between the PVC pipe joint and a service tap (4" and larger) shall be a minimum of 4 feet. Where necessary, excavate along the pipe to confirm the acceptable distance before starting the tap.

**END OF SECTION 15120**



## SECTION 15125

### HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS FOR WATER DISTRIBUTION AND TRANSMISSION

#### PART 1 GENERAL

##### .01 SECTION INCLUDES

Furnishing and installing 4 inch through 16 inch high density polyethylene (HDPE) pipe and fittings for water distribution and transmission.

##### .02 SUBMITTALS

Submit manufacturer's product data, installation instructions, and certification for all materials to be furnished in accordance with Specification Section 1300. Submit classification and gradation test results for material(s) to be used for pipe embedment and backfill.

#### PART 2 PRODUCTS

##### .01 MATERIALS

- A. Research has documented that certain pipe materials (such as polyethylene, polybutylene, polyvinyl chloride, and asbestos cement) and elastomers, such as used in jointing gaskets and packing glands, may be subject to permeation by lower molecular weight organic solvents or petroleum products. Products supplied under this Specification Section assume that petroleum products or organic solvents will not be encountered. If during the course of pipeline installation the Contractor identifies, or suspects the presence of petroleum products or any unknown chemical substance, notify AW immediately. Stop installing piping in the area of suspected contamination until direction is provided by the Engineer.
- B. Pipe and fittings shall be made from the same resin meeting the requirements of the Plastic Pipe Institute (PPI) material designation PE 3408 with an ATSM D3350 minimum cell classification of PE 345464C.
- C. The material shall have a minimum Hydrostatic Design Basis (HDB) of 1,600 psi at 73 degrees F.

- D. All materials which come in contact with water, including lubricants, shall be evaluated, tested, and certified for conformance with ANSI/NSF Standard 61.

## .02 PIPE

- A. All pipe and fittings shall be manufactured in ductile iron pipe sizes (DIPS) only in accordance with AWWA Standard C906.
- B. The pipe shall contain no recycled compound except for rework material generated in the manufacturer's own plant that has the same cell classification as the material to which it is being added. The pipe shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other defects that may affect the wall integrity.
- C. Permanent identification of water piping service shall be provided by co-extruding longitudinal blue stripes into the pipe outside surface. The striping material shall be the same material as the pipe material except for color. Stripes printed or painted on the outside surface shall not be acceptable.
- D. The nominal pipe diameter is specified on the Contract Drawings. The DR (dimension ratio) and the pressure rating of the pipe shall be as noted on the plans.
- E. The minimum pressure rating will be 200 psi.
- F. HDPE may be deflected subject to approval by AW. The following table shows maximum deflection based upon the allowable strain of the pipe wall. Potential flow restrictions, surge and other non-trench stability and pipe strain issues may reduce the values shown here per the Engineer's recommendations. The bend radius multiplier determines the minimum radius of the pipe curvature and is calculated by multiplying the outside diameter of the pipe by the multiplier from the appropriate DR used. Bending radius allowed by the manufacturer can vary. Verify the multiplier with the manufacturer. In no case shall the radius be less than 125% of the manufacturer's permitted multiplier.

PE pipe Dimension Ratio (DR)	Allowable deflection (percent)	Bend Radius Multiplier
32.5	8.1	50
26.0	6.5	45
21.0	5.2	40
19.0	4.7	37.5
17.0	4.2	32.5
15.5	3.9	30
13.5	3.4	27.5
11.0	2.7	25

### .03 FITTINGS

- A. Plain end butt fused fittings and electrofusion couplings shall be used when joining polyethylene materials. Mechanical (compression) fittings shall be used only when joining polyethylene materials to different piping materials and approved by AW.
- B. The fittings shall contain no recycled compound except for rework material generated in the manufacturer's own plant that has the same cell classification as the material to which it is being added. The fittings shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other defects that may affect the wall integrity.
- C. Butt fusion fittings shall comply with ASTM D3261.
- D. Electrofusion fittings shall comply with ASTM F1055.
- E. Mechanical (compression) fittings used with polyethylene pipe shall be specifically designed for, or tested and found to be acceptable for, use with polyethylene pipe.

## PART 3 EXECUTION

### .01 PACKAGING, HANDLING, AND STORAGE

- A. The manufacturer shall ensure that the interior of all pipe is clean and install plastic cleanliness plugs in all pipes to keep the pipe interiors clean. The manufacturer shall package the pipe in a manner designed to ensure that it arrives at the project neat, clean,

intact, and without physical damage. The transportation carrier shall use appropriate methods and intermittent checks to assure that the pipe is properly supported, stacked, and restrained during transport such that the pipe is not nicked, gouged, or physically damaged.

- B. Inspect pipe and appurtenances for defects prior to installation in the trench. Set aside defective, damaged or unsound material and hold material for inspection by AW.
- C. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging. If the pipe must be stacked for storage, such stacking shall be done in accordance with the pipe manufacturer's recommendations. The pipe shall be handled in such a manner that it is not pulled over sharp objects or cut by chokers or lifting equipment.
- D. Sections of pipe having been discovered with cuts or gouges in excess of 10% of the pipe wall thickness shall be cut out and removed. The undamaged portions of the pipe shall be rejoined by butt fusing or the use of electrofusion fittings.

## .02 PIPE INSTALLATION

- A. Refer to Specifications 15000 and referenced drawings that are part of these Contract Documents. Trenching shall be performed in accordance with Specification Section 02317 and embedment materials shall be in accordance with Specification Section 02320.
- B. Remove all dirt and foreign matter from pipe before lowering into the trench. Do not place debris, hand tools, clothing or other materials in the pipe. Keep pipe clean during and after laying.
- C. Maximum pipe bending radius shall be in conformance with the manufacturer's recommendation for the specific diameter and dimension ratio (DR) of the pipe. Whenever possible, changes in direction shall be accomplished by bending the pipe in lieu of installing a fitting, except as approved by the Engineer.
- D. Place location wire immediately above the initial backfill material, directly over the pipe. The wire shall be contiguous except at test stations, valve boxes, and where splicing is required. All splices shall be encased with a 3M-Gel Pack model No. 054007-09053, or

approved equal. Wire insulation shall be highly resistant to alkalis, acid and other destructive agents found in soil.

- E. Prevent flotation of sealed pipe during work stoppages.
- F. HDPE pipe will not be employed with directional drilling through rock and other abrasive conditions unless it is encased.

### .03 PIPE AND FITTING JOINING

- A. Butt fusion and electrofusion procedures shall be in accordance with the manufacturer's recommendations. Surfaces must be clean and dry before joining. The fusion equipment operator shall be fully trained in the use of the respective equipment. The wall thicknesses of the adjoining pipes shall have the same DR at the point of fusion.
- B. Butt fusion equipment shall be equipped with a Datalogger. Records of each weld (including, as a minimum, heater temperature, fusion pressure, and a graph of the fusion cycle) shall be appropriately identified and provided to the Engineer.
- C. Electrofusion reports of each weld shall be appropriately identified and provided to AW. The reports shall include, as a minimum, the fusion date, time, ambient temperature, fitting type and size, user ID, and the manufacturer of the part.
- D. Mechanical (compression) joining of pipe and fittings is only permissible when joining polyethylene pipe to unlike materials. HDPE stiffeners shall be utilized with all mechanical (compression) fittings. Blocking must be provided at changes in direction for any mechanical fittings. Use of positive restrained joints fittings (non-friction type) is permissible when approved by AW.

### .04 SERVICE CONNECTIONS

- A. Sidewall fused polyethylene hot-tapping tees shall be used for 3/4 inch and 1 inch service lines off mains 3 inches to 12 inches in diameter. For larger sized mains, polyethylene service saddles may be used, sidewall fused, and then tapped with a tapping tool or machine.

- B. For large mains (>12 inch), mechanical clamps or tapping saddles may be used provided they are designed for HDPE pipe and acceptable to the manufacturer of the pipe.

#### .05 TESTING AND DISINFECTION

- A. Pressure testing shall be conducted in accordance with the Manufacturer's recommended procedure or as recommended by AW. Pressure testing shall use water as the test media. Pneumatic (air) testing is prohibited. Air must be completely removed before pressure testing. Under no circumstances shall HDPE pipe be pressure tested when the temperature of the pipe is above 80 degrees F.

**END OF SECTION 15125**

**SECTION 02528****POLYETHYLENE WRAP****PART 1 GENERAL****.01 SECTION INCLUDES**

- A. Polyethylene wrap to be used in open-cut construction for ductile iron pipe when cathodic protection system is not required by Drawings.

**.02 SUBMITTALS**

- A. Conform to requirements of Section 01300 - Submittals.
- B. Submit product data for proposed film and tape for approval.

**PART 2 PRODUCTS****.01 MATERIALS**

- A. Polyethylene Film: Tubular or sheet form without tears, breaks, holidays, or defects; conforming with requirements of AWWA C 105, 2.5 to 3 percent carbon black content, either low- or high-density:
  - 1. Low-density polyethylene film. Low-density polyethylene film shall be manufactured of virgin polyethylene material conforming to following requirements of ASTM D 1248.
    - a. Raw material.
      - 1. Type 1
      - 2. Class: C (black).
      - 3. Grade: E-5.
      - 4. Flow rate (formerly melt index): 0.4 g/10 minute, maximum.
      - 5. Dielectric strength: Volume resistivity,  $10^{15}$  ohm-cm, minimum
    - b. Physical properties.
      - 1. Tensile strength: 1,200 psi, minimum.
      - 2. Elongation: 300 percent, minimum.
      - 3. Dielectric strength: 800 V/mil thickness, minimum.

- c. Thickness: Low-density polyethylene film shall have normal thickness of 0.008 inch. Minus tolerance on thickness is 10 percent of nominal thickness.
- 2. High-density, cross-laminated polyethylene film. High-density, cross laminated polyethylene film shall be manufactured of virgin polyethylene material conforming to following requirements of ASTM D 1248
  - a. Raw material.
    - 1. Type: III.
    - 2. Class: C (black)
    - 3. Grade: P33.
    - 4. Flow rate (formerly melt index): 0.4 to 0.5g/10 minute, maximum.
    - 5. Dielectric strength: Volume resistivity,  $10^{15}$  ohm-cm, minimum.
  - b. Physical properties.
    - 1. Tensile strength: 5000 psi, minimum.
    - 2. Elongation: 100 percent, minimum.
    - 3. Dielectric strength: 800 V/mil thickness, minimum.
  - c. Thickness: Film shall have nominal thickness of 0.004 inch. Minus tolerance of thickness is 10 percent of nominal thickness.
- B. Polyethylene Tape: Provide 3-inch-wide, plastic-backed, adhesive tape; Paleocene No. 900, Scotchwrap No. 50, or approved equal.

## PART 3 EXECUTION

### .01 PREPARATION

- A. Remove lumps of clay, mud, and cinders from pipe surface prior to installation of polyethylene encasement. Prevent soil or embedment material from becoming trapped between pipe and polyethylene.
- B. Fit polyethylene film to contour of pipe to affect snug, but not tight fit; encase with minimum space between polyethylene and pipe. Allow sufficient slack in contouring to prevent stretching polyethylene where it bridges irregular surfaces, such as bell-spigot interfaces, bolted joints, or fittings, and to prevent damage to polyethylene due to backfilling operations. Secure overlaps and ends with adhesive tape to hold polyethylene encasement in place until backfilling operations are complete.
- C. For installations below water table or in areas subject to tidal actions, seal both ends of polyethylene tube with adhesive tape at joint overlap.



## .02 INSTALLATION

### A. Tubular Type (Method A):

1. Cut polyethylene tube to length approximately 2 feet longer than pipe section. Slip tube around pipe, centering tube to provide 1-foot overlap on each adjacent pipe section, and bunching it accordion-fashion lengthwise until it clears pipe ends.
2. Lower pipe into trench and make up pipe joint with preceding section of pipe. Make shallow bell hole at joints to facilitate installation of polyethylene tube.
3. After assembling pipe joint, make overlap of polyethylene tube. Pull bunched polyethylene from preceding length of pipe, slip it over end of adjoining length of pipe, and secure in place. Then slip end of polyethylene from adjoining pipe section over end of first wrap until it overlaps joint at end of preceding length of pipe. Secure overlap in place. Take up slack width at top of pipe to make snug, but not tight, fit along barrel of pipe, securing fold at quarter points.
4. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

### B. Tubular Type (Method B):

1. Cut polyethylene tube to length approximately 1 foot shorter than pipe section. Slip tube around pipe, centering it to provide 6 inches of bare pipe at each end. Take up slack width at top of pipe to make snug, but not tight, fit along barrel of pipe, securing fold at quarter points; secure ends.
2. Before making up joint, slip 3-foot length of polyethylene tube over end of preceding pipe section, bunching in accordion-fashion lengthwise. After completing joint, pull 3-foot length of polyethylene over joint, overlapping polyethylene previously placed on each adjacent section of pipe by at least 1 foot; make each end snug and secure.
3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

### C. Sheet Type:

1. Cut polyethylene sheet to length approximately 2 feet longer than pipe section. Center length to provide 1-foot overlap on each adjacent pipe section, bunching sheet until it clears pipe ends. Wrap polyethylene around pipe so that sheet circumferentially overlaps top quadrant of pipe. Secure cut edge of polyethylene sheet at intervals of approximately 3 feet.
2. Lower wrapped pipe into trench and make up pipe joint with preceding section of pipe. Make shallow bell hole at joints to facilitate installation of polyethylene. After completing joint, make overlap and secure ends.

3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.
- D. Pipe-shaped Appurtenances: Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in same manner as pipe.
- E. Odd-shaped Appurtenances: When it is not practical to wrap valves, tees, crosses, and other odd-shaped pieces in tube, wrap with flat sheet or split length of polyethylene tube by passing sheet around appurtenance and encasing it. Make seams by bringing edges together, folding over twice, and taping down. Tape polyethylene securely in place at valve stem and other penetrations.
- F. Openings in Encasement: Create openings for branches, service taps, blow-offs, air valves, and similar appurtenances by making X-shaped cut in polyethylene and temporarily folding back film. After appurtenance is installed, tape slack securely to appurtenance and repair cut, as well as other damaged area in polyethylene, with tape. Service taps may also be made directly through polyethylene, with resulting damaged areas being repaired as specified.
- G. Junctions between Wrapped and Unwrapped Pipe: Where polyethylene-wrapped pipe joins adjacent pipe that is not wrapped, extend polyethylene wrap to cover adjacent pipe for distance of at least 3 feet. Secure end with circumferential turns of tape. Wrap service lines of dissimilar metals with polyethylene or suitable dielectric tape for minimum clear distance of 3 feet away from cast or ductile iron pipe.

### .03 REPAIRS

- A. Repair cuts, tears, punctures, or damage to polyethylene with adhesive tape or with short length of polyethylene sheet or cut open tube, wrapped around pipe to cover damaged area, and secured in place.

### **END OF SECTION 15130**

## SECTION 15150

### GATE VALVES

#### PART 1 GENERAL

##### .01 SCOPE

Furnish, install, and test all gate valves shown on the Drawings.

##### .02 SUBMITTALS

Submit shop drawings and manufacturer's literature to the Engineer for approval in accordance with Specification Section 1300.

#### PART 2 PRODUCTS

##### .01 SMALL GATE VALVES

- A. All gate valves, 3 inches through 12 inches NPS, shall be iron body, resilient-seated, nut-operated, non-rising stem gate valves suitable for buried service. The valve interior and exterior shall be epoxy coated at the factory by the valve manufacturer in accordance with AWWA Standard C550 (6-8 mil average, 4 mil minimum). The valves shall be designed for a minimum differential pressure of 250 psi and a minimum internal test pressure of 500 psi unless otherwise noted on the plans. Valves shall be designed to operate in the vertical position. All valves shall open left (CCW).
- B. Valves shall comply fully with AWWA Standard C509. Valve ends shall be push on joint or MJ (when restrained), or as shown on the plans or approved in writing in accordance with AWWA Standard C111. Stems shall be made of a low zinc alloy in accordance with AWWA C509 4.2.2.4.3. Stem seals shall be double O-ring stem seals. Square operating nuts conforming to AWWA Standard C509 shall be used. Valves shall open (left or right) in accordance with the Owner's standard. All valve materials shall meet the requirements of NSF 61.
- C. Test valves (Operation Test and Hydrostatic Tests) at the manufacturer's plant in accordance with AWWA Standard C509. Provide AW with certified copies of all tests prior to shipment. AW reserves the right to observe all tests.

## .02 LARGE GATE VALVES

- A. Gate valves larger than 12-inches NPS shall be iron body, double disc (metal to metal seat), parallel seats, bronze mounted, rubber O-ring packing seals, epoxy coated interior and exterior meeting the requirements of AWWA Standard C550, and conforming to AWWA Standard C500. Stems shall be made of a low zinc alloy in accordance with AWWA C500 4.2.2.4.3. All valves shall have openings through the body of the same circular area as that of the pipe to which they are attached. All valves furnished shall open (left or right) in accordance with the Owner's standard. All valve materials shall meet the requirements of NSF 61. All valves shall open left (CCW).
- B. Test valves (Operation Test and Hydrostatic Tests) at the manufacturer's plant in accordance with AWWA Standard C515. Provide AW with certified copies of all tests prior to shipment. AW reserves the right to observe all tests.
- C. Valves shall have mechanical joint ends unless otherwise designated on the plans or approved by AW.
- D. The valves shall be designed for a minimum differential pressure of 150 psi and a minimum internal test pressure of 300 psi, unless otherwise noted on the plans. Make all valves tight under their working pressures after they have been placed and before the main is placed in operation. Any defective parts shall be replaced at the Contractor's expense.

## PART 3 EXECUTION

### .01 INSTALLATION

Install the valves in strict accordance with the requirements contained in Specification Section 15000 and detail drawings. All large gate valves shall be restrained.

### .02 PROTECTION

After field installation of the valve all external bolts except the operating nut shall receive a layer of tape coating or approved rubberized-bitumen based spray-on undercoating applied before backfill. If polyethylene is applied to the pipe, the entire valve shall be encased in polyethylene encasement prior to backfill. The polyethylene encasement shall be

installed up to the operating nut leaving the operating nut exposed and free to be operated. Valve box shall be installed per Specification Section 15000.

**END OF SECTION 15150**

## SECTION 15155

### BUTTERFLY VALVES

#### PART 1 GENERAL

##### .01 SCOPE

Furnish and install all butterfly valves shown on the Drawings and/or the Specification Special Conditions.

##### .02 SUBMITTALS

Submit shop drawings and manufacturer's literature to the Engineer for approval in accordance with Specification Section 01300.

#### PART 2 PRODUCTS

##### .01 VALVES

- A. Furnish and install rubber-seated butterfly valves as shown on the Contract Drawings. Butterfly valves shall conform to Class 150B of the AWWA Standard C504 and this specification unless working pressure is greater than 150 psi in which case, the butterfly valve shall conform to Class 250B of the AWWA Standard C504. All valves furnished shall open left or in accordance with the AW's standard.
- B. Valve bodies shall be ductile iron with mechanical joint ends. Mechanical joint ends shall conform to AWWA Standard C111. All valve materials shall meet the requirements of NSF 61.
- C. Valve shafts shall consist of one-piece units extending through the discs of 18-8 stainless steel Type 303 or 304. Shaft diameter shall be in accordance with Table 3 of AWWA Standard C504.
  1. Valve discs shall be Ni-Resist, Type 1, or cast iron with stainless steel edges.
  2. Valve seats shall be hycar or natural rubber mounted in the valve body.
  3. Valve bearings shall be nylon or Teflon.

- D. The valve interior and exterior shall be epoxy coated at the factory by the valve manufacturer in accordance with AWWA Standard C550 (6-8 mil average, 4 mil minimum).
- E. All elastomers used in the butterfly valves must be suitable for service in the following water conditions:
- Chlorine concentration up to 12 mg/L
  - Chloramine concentrations up to 6 mg/L
  - Ozone concentrations up to 2.0 mg/L (AWWA Standard says 0.5 ppm)
  - pH range of 4-11
- F. Manual buried operators, if provided, shall be either worm gear or traveling nut type and shall be furnished with 2-inch AWWA nuts and extension shafts. Input required at nuts to produce specified output torque shall be less than 150 ft.-lbs. Operators shall be designed to withstand an input at the nut of 300 ft.-lb. without damage to any operator components.

### **PART 3 EXECUTION**

#### **3.01 SETTING VALVES**

Install the valves in strict accordance with the requirements of Specification Section 15000. All butterfly valves shall be restrained.

#### **3.02 PROTECTION**

After field installation of the valve all external bolts except the operating nut shall receive a layer of tape coating or approved rubberized-bitumen based spray-on undercoating applied before backfill. If polyethylene is applied to the pipe, the entire valve shall be encased in polyethylene encasement prior to backfill. The polyethylene encasement shall be installed up to the operating nut leaving the operating nut exposed and free to be operated.

**END OF SECTION 15155**

## SECTION 15160

### PRESSURE REDUCING VALVES

#### PART 1 GENERAL

##### .01 SCOPE

- A. This section includes pressure reducing valves (PRV).

##### .02 SUBMITTALS

- A. Conform to requirements of Section 01300 - Submittal Procedures.
- B. Submit manufacturer's product data for proposed valves for approval.
- C. Submit design calculations and shop drawings for valve vaults and manholes, sealed by Engineer registered in the State.

#### PART 2 PRODUCTS

##### .01 MATERIALS

- A. Provide approved PRV with basket strainer in location and arrangement as shown on Drawings.
  - 1. Valve body: Ductile iron with ASME B16.1, Class 125, flanges.
  - 2. Valve cover: ASTM A 48 cast iron.
  - 3. Valve internals:
    - a. Provide top and bottom single moving disc and diaphragm assembly.
    - b. Use flexible nylon fabric reinforced elastomer diaphragm integral with assembly.
    - c. Provide valve internal trim (seat ring, disc guide, and cover bearing) made of stainless steel.
    - d. Provide heat fusion bonded epoxy coating to internal and external surfaces of valve body including disc retainer and diaphragm washer. Holiday test coating applied to valve body.
    - e. Treat stem and seat with penetrative salt nitride process.
    - f. Use Xylan coated seat.
    - g. Do not use leather parts.
- B. Control Tubing: Contain shutoff cocks with Y-strainer.



- C. PRV: Equip with visual valve position indicator. Fit valve position indicator with air-bleed petcock. Initially set in field by authorized manufacturer's representative with 60 psi downstream pressure.
- D. Provide basket strainer upstream of PRV as shown on Drawings.
  - 1. Strainer body: Quick-opening type, fabricated-steel construction with ANSI B 16.1, Class 150, flanges.
  - 2. Basket: Type 304, stainless steel.
  - 3. Model: Provide basket compatible with the manufacturer of the pressure reducing valve. Hayward Model 90, or approved equal, for PRV 4 inches through 24 inches. Provide Hayward Model 510, or approved equal, for PRV 14 inches or greater when space limitations dictate use of smaller strainer housing.
- E. Provide pressure reducing pilot that has adjustable range of 20 - 175 psi. Provide and install pilot system components according to manufacturer's recommendations unless otherwise approved by Project Manager.
- F. Valve Vaults: Provide as shown on Drawings and conforming to requirements of Section 03500 - Valve Boxes and Meter Vaults.

### **PART 3 EXECUTION**

#### **.01 SETTING VALVES**

- A. Provide services of technical representative of valve manufacturer on site during installation of valves and to serve as adviser on aspects of installation. Take necessary precautions to protect pilot system during PRV installation.
- B. Prior to installing valves, remove foreign matter from within valves. Inspect valves in open and closed position to verify that parts are in satisfactory working condition.

#### **.02 DISINFECTION AND TESTING**

- A. Disinfect water lines, valves, and appurtenances as required by Section 15120.

#### **.03 PAINTING OF PIPING AND VALVES**

- A. Paint piping and valves located in vaults, stations, and above ground using ACRO Paint No. 2215, or approved equal.

**END OF SECTION 15160**

## SECTION 15170

### TAPPING SLEEVES, SADDLES AND VALVES

#### PART 1 GENERAL

##### .01 SCOPE

Furnish, install and test all tapping sleeves, tapping valves, and tapping saddles as shown on the Drawings.

##### .02 RELATED WORK

Specification Section 15000 - Piping - General Provisions

##### .03 SUBMITTALS

Submit shop drawings and manufacturer's literature to the Engineer for approval in accordance with Specification Section 01300.

#### PART 2 PRODUCTS

##### .01 GENERAL

All tapping sleeves, saddles and valves shall be designed for a working pressure of at least 250 psig for 12-inch and smaller. The valves shall be designed for a minimum differential pressure of 250 psi and a minimum internal test pressure of 500 psi unless otherwise noted on the plans.

##### .02 DUCTILE IRON TAPPING SLEEVES

Verify the type of existing pipe and the outside diameter of the pipe on which the tapping sleeve is to be installed.

Tapping sleeves shall be ductile iron dual compression type unless otherwise specified on the Drawings. The Drawings may require the use of corrosion resistant tapping sleeves in addition to polywrap in areas with corrosive soils. The sleeves shall be made in two halves which can be assembled and bolted around the main. Sleeves shall meet the requirements of NSF 61. Outlet flanges shall conform to the flange requirements of AWWA C110. All valves furnished shall open left in accordance with the AW's standard.

### .03 TAPPING VALVES

The horizontal tapping valve shall conform to the applicable requirements of AWWA Standard C509. All tapping valves, 3 inches through 12 inches NPS, shall be ductile iron body, resilient-seated, nut-operated, non-rising stem gate valves suitable for buried service. The valve interior and exterior shall be epoxy coated at the factory by the valve manufacturer in accordance with AWWA Standard C550 (6-8 mil average, 4 mil minimum). The tapping valves shall have flanged inlets with mechanical joint outlets, enclosed bevel gears, bypass valve, rollers, tracks and scrapers. All valves furnished shall open left in accordance with the AW's standard.

### .04 STAINLESS STEEL TAPPING SLEEVES

The stainless steel band flange shall be manufactured in compliance with AWWA C207, Class D ANSI B.16.1 drilling, recessed for tapping valve MSS-SP60. Mechanical Joint tapping sleeve outlet shall meet or exceed all material specifications as listed below and be suitable for use with standard mechanical joint by mechanical joint resilient wedge gate valves per ANSI/AWWA C509-94 and be NSF 61 approved.

#### A. Tapping sleeves from 4" through 12"

Tapping sleeves to be attached to 4" through 12" nominal pipe diameter shall meet the following minimum requirements.

1. The entire fitting shall be stainless steel type 304 (18-8). The body, lug, and gasket armor plate shall be in compliance with ASTM A240. The Flange shall be cast stainless steel in compliance with ASTM A743. The MJ outlet shall be one-piece casting made of stainless steel. The test plug shall be ¾" NPT in compliance with ANSI B2.1 and shall be lubricated or coated to prevent galling. All metal surfaces shall be passivated after fabrication in compliance with ASTM A-380.
2. The gasket shall provide a 360-sealing surface of such size and shape to provide and adequate compressive force against the pipe after assembly, to affect a positive seal under the combinations of joint and gasket tolerances. The materials used shall be vulcanized natural or vulcanized synthetic rubber with antioxidant and antiozonant ingredients to resist set after installation. No reclaimed rubber shall be used. A heavy-gauge-type 304-stainless armor plate shall be vulcanized into the gasket to span the lug area.
3. The lugs shall be heliarc welded (GMAW) to the shell. The lug shall have a pass-through-bolt design to avoid alignment problems and

allow tightening from either side of the main. Bolts shall NOT BE integrally welded to the sleeve. Finger Lug designs are not approved; it is the intent of these specifications to allow a tapping sleeve that has a lug design similar to the approved models.

4. Bolts and nuts shall be type 304 (18-8) stainless steel and Teflon coated or as specified in the bolt section below at the discretion of the Engineer. Bent or damaged units will be rejected.
5. Quality control procedures shall be employed to insure that the shell, Lug, (4" and Larger Nominal Pipe Diameter) armor plate, gasket and related hardware are manufactured to be free of any visible defects. Each unit, after proper installation, shall have a working-pressure rating up to 250 psi.
6. The sleeve construction shall provide a positive means of preventing gasket cold flow and/or extrusion.
7. Each sleeve shall be stenciled, coded or marked in a satisfactory manner to identify the size range. The markings shall be permanent type, water resistant, that will not smear or become illegible.

B. Tapping sleeves from 16" and larger

Tapping sleeves attached to 16" and larger nominal pipe diameter shall meet the following minimum requirements:

1. The body shall be in compliance with ASTM A285, Grade C or ASTM A36. The test plug shall be ¾" NPT conforming to ANSI B2.1.
2. The gasket shall provide a watertight sealing surface of such size and shape to provide an adequate compressive force against the pipe. After assembly, the gasket will insure a positive seal under all combinations of joint and gasket tolerances. Gaskets shall be formed from vulcanized natural or vulcanized synthetic rubber with antioxidant ingredients to resist set after installation. No reclaimed rubber shall be used.
3. Bolts and nuts shall be high strength, corrosion resistant, low alloy, pre AWWA C111, ANSI A21.11 and as specified in the subsection on bolts in this specification.
4. Quality control procedures shall be employed to insure that the shell, gaskets, and related hardware area are manufactured to be

free of visible defects. Each unit, after proper installation, shall have a working-pressure rating up to 200 psi.

5. Unless otherwise noted, unit shall be protected by electrostatically applied baked epoxy or polyurethane.
6. Units for concrete, steel cylinder pipe shall be furnished with load bearing setscrews on the gland flange to transfer loads on the outlet away from the steel cylinder and onto the sleeve. Epoxy – coated tapping sleeves do not require grout seal cavity (AWWA M-9 Manual).
7. Each sleeve shall be stenciled, coded or marked in a satisfactory manner to identify the size range. The marking shall be permanent type, water resistant, that will not smear or become illegible.

#### .05 FABRICATED STEEL TAPPING SLEEVE

The fabricated steel tapping sleeve shall be manufactured in compliance with AWWA C207. Sleeves shall be fabricated of minimum three-eighths (3/8) inch carbon steel meeting ASTM A285 Grade C. Outlet flange shall meet AWWA C-207, Class "D" ANSI 150 lb. drilling and be properly recessed for the tapping valve. Bolts and nuts shall be high strength low alloy steel to AWWA C111 (ANSI A21.11). Gasket shall be vulcanized natural or synthetic rubber. Sleeve shall have manufacturer applied fusion bonded epoxy coating, minimum 12 mil thickness, Class D ANSI B.16.1 drilling, recessed for tapping valve MSS-SP60. Mechanical Joint tapping sleeve outlet shall meet or exceed all material specifications as listed below and be suitable for use with standard mechanical joint by mechanical joint resilient wedge gate valves per ANSI/AWWA C509-94 and be NSF 61 approved.

#### .06 TAPPING SADDLES

Unless otherwise specified by the Drawings, tapping saddles conform to the requirements of AWWA Standard C800 for the High Pressure class tapping saddles. Tapping saddles shall consist of ductile iron outlet castings, attached to the pipeline with high strength stainless steel straps. Castings shall be sealed to pipeline with O-ring seals. Saddles shall have ANSI A21.10 flanged outlets counterbored for use with tapping valves and tapping equipment.

#### .07 BOLTS

All bolts shall have American Standard heavy unfinished hexagonal head and nut dimensions all as specified in ANSI B18.2. Bolts shall be Xylan or FluoroKote #1 suitable for direct bury in corrosive soils.

### **PART 3 EXECUTION**

#### **.01 INSTALLATION**

Install the tapping sleeves, saddles, and valves in strict accordance with the requirements of Specification Section 15000. Install the tapping sleeves, tapping saddles, and tapping valves in accordance with the manufacturer's instructions. The tapping procedure is to be in accordance with the tapping machine manufacturer's instructions.

#### **.02 PROTECTION**

After field installation of the valve all external bolts except the operating nut shall receive a layer of tape coating or approved rubberized-bitumen based spray-on undercoating applied before backfill. If polyethylene is applied to the pipe, the entire sleeve and valve assembly shall be encased in polyethylene encasement prior to backfill. The polyethylene encasement shall be installed up to the operating nut leaving the operating nut of the tapping valve exposed and free to be operated

#### **.03 PRELIMINARY TESTING**

Perform a hydrostatic test of the tapping sleeve and valve assembly in accordance with Specification Section 15030 after installation of the tapping sleeve and valve, but prior to making the tap. The test shall be made with the valve open using a tapped mechanical joint cap. No leakage is acceptable. The test pressure shall be maintained for a minimum of 15 minutes.

Perform hydrostatic test of tapping saddles in accordance with AWWA Standard C800.

### **END OF SECTION 15170**



## SECTION 15180

### FIRE HYDRANTS

#### PART 1 GENERAL

##### .01 SCOPE

- A. Fire hydrants.
- B. Adjustment of fire hydrants and gate valves.

##### .02 SUBMITTALS

- A. Conform to requirements of Section 01300 - Submittals.
- B. Submit name of hydrant manufacturer, type of bonnet paint, and engineering control drawing number for hydrant proposed for use.

#### PART 2 PRODUCTS

##### .01 HYDRANTS

- A. Provide hydrants in conformance with AWWA C 502, Standard for Dry Barrel Fire Hydrants (Latest Edition). Hydrants are approved by AW by issuance of a Certificate of Responsibility. Hydrants shall open left (counterclockwise). The following hydrant has been approved. Alternate hydrants will not be considered.

##### APPROVED HYDRANT TYPE

- Shall be determined by the AW Project Manager and also shown in the Notes section of this specification.
- B. The AW Project Manager may, at any time prior to or during installation of hydrants, randomly select furnished hydrant for disassembly and laboratory inspection, at AW's expense, to verify compliance with Specifications. When hydrant is found to be non-compliant, replace, at Contractor's expense, hydrants, with hydrants that comply with Specifications.
- C. Provide lower hydrant barrel fabricated from Ductile Iron Pipe as single piece, connected to upper hydrant barrel by means of joint coupling that will provide three hundred sixty (360) degree rotation of upper barrel.

##### .02 LEADS

- A. Branches (Leads): Conform to requirements of Section 15105 - Ductile Iron Pipe and Fittings and Section 15120 - Polyvinyl Chloride Pipe.





### .03 HYDRANT PAINTING

- A. New hydrants and refurbished hydrants shall be shop coated as specified herein.
- B. Exterior Above Traffic Flange (Including Bolts & Nuts).
  - 1. Surface preparation to be in accordance with SSPC-SP 10 (NACE 2) near white blast cleaned surface.
  - 2. Coat with three coat alkyd/silicone alkyd system with total dry film thickness (DFT) of 6 - 9 mils as follows:
    - a. Prime Coat - Oil modified alkyd primer, to be in general conformance with SSPC Paint Specification No. 25. Total dry film thickness (DFT) 2 - 3 mils.
    - b. Intermediate Coat - Heavy Duty Industrial Alkyd Enamel to be in general conformance with SSPC Paint Specification No. 104, and Federal Standard A-A-2962A. Total dry film thickness (DFT) of 2 -3 mils.
    - c. Finish Coat - Silicone Alkyd Resin Enamel to be in general conformance with SSPC Paint Specification No. 21. Total dry film thickness (DFT) to be 2 - 3 mils. Exception - hydrant bonnet shall not be finished shop coated, only intermediate coated. Install color coded finish coating of bonnet in field.
    - d. Bonnet Paint - Field apply finish coat of Silicone Alkyd Resin Enamel to be in general conformance with SSPC Paint Specification No. 21. Dry film thickness of 2 - 3 mils. Bonnet colors are to be as specified in Paragraph 3.01 to designate the appropriate size of water supply line.
  - 3. Colors - Primer: Manufacturers standard color. Finish coat of hydrant body and connection caps, to be painted gloss 'Red' to match the color of existing in service hydrants on the base. Approval of the shade of 'Red' color to be by the on base American Water 'Director of Operations' prior to the final application of paint to the newly installed hydrant.
- C. Field Maintenance Painting (Exterior Above Traffic Flange)
  - 1. Surface Preparation to be in accordance with SSPC - SP2, Hand Tool Cleaning, or SSPC - SP3, Power Tool Cleaning, depending on condition of existing paint and extent of corrosion. It is not necessary to remove tightly adhered mill scale, rust, and paint. Mill scale, rust and paint are considered tightly adherent when they cannot be removed with dull putty knife. In some severe cases where it is necessary to remove majority of existing paint, surface should be cleaned in accordance with SSPC - SP11, Power Tool Cleaning to Bare Metal.
  - 2. When surface is cleaned to bare metal (SSPC - SP11), coat hydrant with three coat Alkyd/Silicone Alkyd system in accordance with Paragraph





2.03.B.2 as for new hydrants. When surface is cleaned to SSPC - SP2 or SSPC - SP3, coat hydrant with Silicone Alkyd Resin Enamel in general conformance with SSPC Paint Specification No. 21. Total dry film thickness of 3 - 6 mils surface is cleaned to bare metal (SSPC - SP11), coat hydrant with three coat Alkyd/Silicone Alkyd system in accordance with Paragraph 2.03.B.2 as for new hydrants.

D. Exterior Below Traffic Flange

1. Surface preparation in accordance with SSPC- SP10 (MACE 2) Near White Blast Cleaned Surface.
2. Primer and intermediate coat: coal tar epoxy in general conformance with SSPC Paint Specification No. 16. Apply two (2) coats with dry film thickness (DFT) of 8 - 10 mils each for total DFT of 16 -20 mils.
3. Finish coat: Water based vinyl acrylic mastic Apply one coat with dry film thickness of 6 - 8 mils. Color of finish coat to be same as finish coat for exterior above traffic flange, i.e., glossy Red

E. Interior Surfaces Above and Below Water Line Valve

1. Material used for internal coating of hydrant interior ferrous surfaces below water line valve must meet the requirements of local state standards.
2. Coating shall be liquid or powder epoxy system in accordance with AWWA Standard C - 550 (latest revision). Coating may be applied in two or three coats, according to manufacturer's recommendations, for total dry film thickness of 12 -18 mils.

## PART 3 EXECUTION

### .01 INSTALLATION

- A. Set fire hydrant plumb and brace at locations and grades as shown on Drawings. When barrel of hydrant passes through concrete slab, place 1-inch-thick piece of standard sidewalk expansion joint material around section of barrel passing through concrete.
- B. Locate nozzle center line minimum 18 inches above finish grade.
- C. Place 12-inch by 12-inch yellow indicators (plastic, sheet metal, plywood, or other material approved by Project Manager) on pumper nozzles of new or relocated fire hydrants installed on new water lines not in service. Remove indicators after new water line is tested and approved by Project Manager.
- D. Do not cover drain ports when placing concrete thrust block.
- E. Obtain Project Manager's approval in writing prior to installation of



hydrants which require changes in bury depth due to obstructions not shown on Drawings. Unit price adjustments will not be allowed for changes in water line flow line or fire hydrant barrel length caused by obstructions.

- F. Plug branch lines to valves and fire hydrants shown on Drawings to be removed. Deliver fire hydrants designated for salvage to the American Water on base depot location.
- G. Install branches (leads) in accordance with Section 15050.
- H. Coating Requirements:
  - 1. Apply coatings in strict accordance with manufacturer's recommendations. No requirements of this specification shall cancel or supersede written directions and recommendations of specific manufacturer so as to jeopardize integrity of applied system.
  - 2. Furnish affidavit of compliance that coatings furnished complies with requirements of this specification and referenced standards, as applicable.
- I. Provide a color code for the hydrant bonnet to indicate size of water line supplying hydrant in accordance with the color scheme 'as directed' by the American Water Director of Operations for the base location:

Supply Water Line Diameter (inches)	Bonnet Color
6	As directed
8	As directed
12-20	As directed
24 and larger	As directed

- J. Remove and dispose of unsuitable materials and debris in accordance with requirements of Waste Material Disposal.

**END OF SECTION 15180**

## **SECTION 15185**

### **ABANDONMENT OF WATERMAINS**

#### **PART 1 GENERAL**

##### **.01 SCOPE**

- A. Cut, plug and abandonment of watermains.

##### **.02 SUBMITTALS**

- A. Conform to requirements of Section 01300 - Submittals.
- B. Submit product data for proposed plugs and clamps for approval.

#### **PART 2 PRODUCTS**

##### **.01 MATERIALS**

- A. Concrete for reaction blocks: Class B conforming to requirements of Section 03330 – Cast-In-Place Concrete.
- B. Plugs and clamps: Applicable for type of pipe to be plugged.

#### **PART3 EXECUTION**

##### **.01 APPLICATION**

- A. Do not begin cut, plug and abandonment operations until replacement watermain has been constructed, disinfected, and tested, and service lines have been transferred to replacement watermain.
- B. Install plug, clamp, and concrete reaction block and make cut at location shown on drawings.
- C. Main to be abandoned shall not be valved off and shall not be cut or plugged other than at supply watermain or as shown on Drawings.
- D. After watermain to be abandoned has been cut and plugged, check for other sources feeding abandoned watermain. When sources are found,

notify AW Project Manager immediately. Cut and plug abandoned watermain at point of other feed as directed by AW Project Manager.

- E. Plug or cap ends or openings in abandoned watermain in manner approved by AW Project Manager.
- F. Remove and dispose of surface identifications such as valve boxes and fire hydrants. Valve boxes in improved streets, other than shell, may be filled with concrete after removing cap.
- G. Backfill excavations in accordance with Section 02317 - Excavation and Backfill for Utilities.
- H. Repair street surfaces in accordance with Section 02614- Curbs, Driveways, and Sidewalks.
- I. Service lines shall be cut and capped at both ends. Cut on water main end shall be within 5' of the existing water main. Cut on service end shall be at Point of Demarcation of the service line in question.

#### **END OF SECTION 15185**

## SECTION 15186

### ABANDONMENT OF SEWERS

#### PART 1 GENERAL

##### .05 SECTION INCLUDES

- A. Abandonment in place of existing sewers, junction structures, manholes, service lines, and force mains. Abandonment using flowable fill will be at the direction of the Owner as field conditions dictate, or as specified on the Drawings.

##### .06 DEFINITIONS

- A. Abandonment. Sewer abandonment consists of demolition and removal of portion of manholes existing within specified depth of surface, and abandonment in place of sewer lines and manholes as specified in this Section.
- B. Flowable Fill. Flowable fill (abandonment grout) shall be controlled low-strength material consisting of fluid mixture of cement, fly ash, aggregate, water and with admixtures as necessary to provide workable properties. Placement of flowable fill may be by grouting techniques in sewer pipes or other restricted areas, or as mass placement by chutes or tremie methods in unrestricted locations with open access. Long-term hardened strength shall be within specified range.
- C. Ballast. Large aggregate either replaced with voids subsequently filled with flowable fill injected by grouting method; or in areas with open access, placed individually and sequentially at same time as flowable fill placement.
- D. Backgrouting. Secondary stage pressure grouting to ensure that voids have been filled within abandoned sewer. Backgrouting will only be required at critical locations indicated on Drawings or if there is evidence of incomplete flowable fill placements.

##### .07 SUBMITTALS

- A. Conform to requirements of Section 01300 - Submittals.
- B. Submit product data for proposed plugs for approval.
- C. Flowable fill mix design report:
  - 1. Flowable fill type and production method. Describe if fill will be mixed to final proportions and consistency in batch plant or if constituents will be

added in transit mixer at placement location.

2. Use of ballast. Provide percentage of ballast of total placement and size limits for ballast if fill is intended to be used with ballast.
  3. Aggregate gradation of fill. Aggregate gradation of mix (excluding ballast) shall be used as pilot curve for quality control during production.
  4. Fill mix constituents and proportions including materials by weight and volume, and air content but excluding ballast. Give types and amounts of admixtures including air entrainment or air generating compounds.
  5. Fill densities and viscosities, including wet density at point of placement.
  6. Initial time of set.
  7. Bleeding and shrinkage.
  8. Compressive strength.
- D. Technical information for equipment and operational procedures including projected slurry injection rate, grout pressure, method of controlling grout pressure, bulkhead and vent design, and number of stages of grout application.
- E. Experience record for proposed crew, showing minimum of 100 cubic yards of flowable fill placed using proposed or similar equipment and methods.
- F. At least 60 days prior to commencing abandonment activities, submit plan for abandonment, describing proposed grouting sequence, bypass pumping requirements and plugging, if any, and other information pertinent to completion of work.

## PART 2 PRODUCTS

### .01 FLOWABLE FILL

- A. Design Mix Criteria. Provide design of one or more mixes to meet design criteria and conditions for placement. Present information required by Paragraph 1.05.B in mix design report including following:
1. Cement: ASTM C 150 Type I or II. Volume and weight per cubic yard of fill. Provide minimum cement content of 100 pounds per cubic yard.
  2. Fly ash: ASTM C 618 Class C or F. Volume and weight per cubic yard of fill. Provide minimum Fly ash content of 200 pounds per cubic yard.
  3. Potable water: Volume and weight per cubic yard of fill. Amount of water determined by mix design testing.
  4. Aggregate gradation: 100 percent passing 3/8-inch sieve and not more than 10 percent passing No. 200 sieve. Mix design report shall define pilot

gradation based on following sieve sizes 3/8-inch, Nos. 4, 8, 16, 30, 50, 100, and 200. Do not deviate from pilot gradation by more than plus or minus 10 percentage points for any sieve for production material.

5. Aggregate source material: Screened or crushed aggregate, pit or bank run fine gravels or sand, or crushed concrete. If crushed concrete is used, add at least 30 percent of natural aggregate to provide workability.
  6. Admixtures: Use admixtures meeting ASTM C 494 and ASTM C 1017 as needed to improve pumpability, to control time of set, and reduce bleeding.
  7. Fluidifier: Use fluidifier meeting ASTM C 937 as necessary to hold solid constituents in suspension. Add shrinkage compensator if necessary.
  8. Performance additive: Use flowable fill performance additive, such as Darafill or approved equal, to control fill properties.
- B. Flowable Fill Requirements
1. Unconfined compressive strength: minimum 75 psi and maximum 150 psi at 56 days as determined based on an average of three tests for same placement. Present at least three acceptable strength tests for proposed mix design in mix design report.
  2. Placement characteristics: self-leveling.
  3. Shrinkage characteristics: non-shrink.
  4. Water bleeding for fill to be placed by grouting method in sewers: not to exceed 2 percent according to ASTM C 940.
  5. Minimum wet density: 90 pounds per cubic foot.

## .02 BALLAST

- A. Ballast Material: Natural rock or concrete pieces with minimum size equal to at least 10 times maximum aggregate size of flowable fill and maximum size of 24 inches. Maximum dimension shall not be more than 20 percent of minimum dimension of space to be filled.
- B. Ballast Composition: Free of regulated waste material.

### .03 PLUGS

- A. Grout Plugs: Cement-based dry-pack grout conforming to ASTM C 1107, Grade B or C.
- B. Manufactured Plug: Commercially available plug or cap specifically designed and manufactured to be used with pipe being abandoned.

## **PART 3 EXECUTION**

### .01 CUTTING AND CAPPING OF MAINS

- A. Do not begin cut, plug, and abandonment operations until replacement sewer has been constructed and tested, and all service connections have been installed.
- B. Install plug, clamp, and concrete reaction block and make cut at location shown on drawings.
- C. Main to be abandoned shall not be valved off and shall not be cut or plugged other than as shown on drawings.
- D. After main to be abandoned has been cut and capped, check for other sources feeding abandoned sewer main. When sources are found, notify AW Project Manager immediately. Cut and cap abandoned main at point of other feed as directed by AW Project Manager.
- E. Plug or cap ends or opening in abandoned main in manner approved by AW Project Manager. Install concrete around cap and over pipe to ensure its not penetratable by groundwater. Before backfilling of a capped service line is started, the capping must be observed by a representative of the Owner
- F. Removed and dispose of surface identifications such as valve boxes. Valve boxes in improved streets, other than shell, may be filled with concrete after removing cap.
- G. Backfill excavations in accordance with Section 02317 – Excavation and Backfill for Utilities.
- H. Repair steet surfaces in accordance with Section 02614 – Curbs, Driveways, and Sidewalks.
- I. Mark location of abandonend sewer laterals on drawings and provide to Owner.



## .02 CUTTING AND CAPPING OF SERVICES

- A. Do not begin cut, plug, and abandonment operations until replacement service, if necessary, has been constructed and tested, and all service connections have been installed.
- B. Service lines shall be cut and capped in two locations. The service line shall be cut and capped as close to the main as practical but no more than 5' from the main unless obstacles exist to prevent the same (pavement, other utilities, etc). Services shall also be cut and capped 5' from the building envelope.
- C. Before backfilling of a capped service line is started, the capping must be observed by a representative of the Owner.
- D. After service to be abandoned has been cut and capped, check for any other sources feeding abandoned sewer service. When sources are found, notify AW Project Manager immediately. Cut and cap abandoned main at point of other feed as directed by AW Project Manager.
- E. Plug or cap ends or opening in abandoned service in manner approved by AW Project Manager. Install concrete around cap and over pipe to ensure its not penetratable by groundwater.
- F. Removed and dispose of surface identifications such as cleanouts. Clean-outs in improved streets, shall be filled with concrete.
- G. Backfill excavations in accordance with Section 02317 – Excavation and Backfill for Utilities.
- H. Repair paved surfaces in accordance with Section 02614 – Curbs, Driveways, and Sidewalks.
- I. Mark location of abandonend sewer laterals on drawings and provide to Owner.

## .03 ABANDONMENT OF FORCE MAINS

- A. Do not begin cut, plug and abandonment operations until replacement force main has been constructed and tested, and all service connections have been installed.
- B. Install plug, clamp, and concrete reaction block and make cut at location shown on drawings.
- C. Main to be abandoned shall not be valved off and shall not be cut or plugged other than as shown on Drawings.
- D. After force main to be abandoned has been cut and plugged, check for other sources feeding abandoned force main. When sources are found,

notify AW Project Manager immediately. Cut and plug abandoned force main at point of other feed as directed by AW Project Manager.

- E. Plug or cap ends or openings in abandoned force main in manner approved by AW Project Manager.
- F. Remove and dispose of surface identifications such as valve boxes. Valve boxes in improved streets, other than shell, may be filled with concrete after removing cap.
- G. Backfill excavations in accordance with Section 02317 - Excavation and Backfill for Utilities.
- H. Repair street surfaces in accordance with Section 02614- Curbs, Driveways, and Sidewalks.

#### .04 PREPARATION FOR FLOWABLE FILL

- A. Have fill mix design reports and other submittals required by Paragraph 1.05 accepted by the AW Project Manager prior to start of placement. Notify the AW Project Manager at least 24 hours in advance of grouting with flowable fill.
- B. Select fill placement equipment and follow procedures with sufficient safety and care to avoid damage to existing underground utilities and structures. Operate equipment at pressure that will not distort or imperil portion of work, new or existing.
- C. Clean sewer lines and video with closed circuit television to identify connections, locate obstructions, and assess condition of pipe. Locate previously unidentified connections, which have not been redirected and reconnected as part of this project, and report them to the AW Project Manager. During placement of fill, compensate for irregularities in sewer pipe, such as obstructions, open joints, or broken pipe to ensure no voids remain unfilled.
- D. Perform demolition work prior to starting fill placement. Clean placement areas of sewers and manholes of debris that may hinder fill placement. Remove excessive amounts of sludge and other substances that may degrade performance of fill. Do not leave sludge or other debris in place if filling more than 2 percent of placement volume.
- E. Remove free water prior to starting fill placement.

## .05 EQUIPMENT FOR FLOWABLE FILL

- A. Mix flowable fill in automated batch plant and deliver it to site in ready-mix trucks. Performance additives may be added at placement site if required by mix design.
- B. Use concrete or grout pumps capable of continuous delivery at planned placement rate.

## .06 DEMOLITION OF SEWER MANHOLES, PIPELINE STRUCTURES, AND FORCE MAINS PRIOR TO ABANDONMENT

- A. Remove manhole frames and covers and castings from other existing pipeline structures. Deliver castings to nearest AW maintenance facility for future use. Alternatively, salvaged castings may be used upon approval by the AW Project Manager, for constructing new manholes on this project.
- B. Demolish and remove precast concrete adjustment rings and corner section, or brick and mortar corbel and chimney, or other pipeline structure, to minimum depth of 4 feet below finished grade. Structure may be removed to greater depth, but not deeper than 18 inches above crown of abandoned sewer.
- C. When adjacent sewer lines are not to be filled, place temporary plugs in each line connecting to manhole, in preparation for filling manhole.
- D. Excavate overburden from force mains to be abandoned at locations indicated on Drawings, conforming to Section 02317 - Excavation and Backfill for Utilities. Cut existing force main, when necessary, to provide an end surface perpendicular to axis of pipe and suitable for plug to be installed. Remove force main piping material remaining outside of segment to be abandoned.

## .07 INSTALLATION OF FLOWABLE FILL

- A. Abandon sewer lines by completely filling sewer line with flowable fill. Abandon manholes and other structures by filling with flowable fill, together with ballast as applicable, within depth of structures left in place.
- B. Place flowable fill to fill volume between manholes. Continuously place flowable fill from manhole to manhole with no intermediate pour points, but not exceeding 500 feet in length.
- C. Have filling operation performed by experienced crews with equipment to monitor density of flowable fill and to control pressure.
- D. Temporarily plug sewer lines which are to remain in operation during pouring/pumping to keep lines free of flowable fill.

- E. Pump flowable fill through bulkheads constructed for placement of two 2-inch PVC pipes or use other suitable construction methods to contain flowable fill in lines to be abandoned. These pipes will act as injection points or vents for placement of flowable fill.
- F. Place flowable fill under pressure flow conditions into properly vented open system until flowable fill emerges from vent pipes. Pump flowable fill with sufficient pressure to overcome friction and to fill sewer from downstream end, to discharge at upstream end.
- G. Inject flowable fill through replaced ballast using grouting equipment and series of grout pipes discharging at bottom of placement, allowing fill to rise through ballast effectively filling all voids. Alternatively, sequentially place individual pieces of ballast at same time as flowable fill is placed. Do not fill with ballast more than 50 percent of volume at any level, to prevent nesting and void formation.
- H. Remediate placement of flowable fill which does not fill voids in sewer, in manhole or other structures, or where voids develop due to excessive shrinkage or bleeding of fill, by using pressure grouting either from inside sewer or from surface.
- I. Plug each end of force main being abandoned.
- J. Force main abandonment
  - 1. Clean inside surface of force main at least 12 inches from ends to achieve firm bond and seal grout plug or manufactured plug to pipe surface. Similarly, clean and prepare exterior pipe surface if manufactured cap is to be used.
  - 2. When using grout plug, place temporary plug or bulkhead approximately 12 inches inside pipe. Fill pipe end completely with dry-pack grout mixture.
  - 3. When using manufactured plug or cap, install fitting as recommended by manufacture's instructions, to form water tight seal.
- K. Backfill to surface, above pipe or structures left in place, with flowable fill in restricted areas, compacted bank run sand in unrestricted areas to be paved or select fill in unrestricted areas outside of pavement. Place and compact backfill, other than flowable fill, in compliance with Section 02317 - Excavation and Backfill for Utilities.
- L. Collect and dispose of excess flowable fill material and other debris in accordance with Waste Material Disposal or as directed by the AW Project Manager.

**.08 FIELD QUALITY CONTROL**

- A. Provide batch plant tickets for each truck delivery of flowable fill. Note on tickets addition of admixtures at site.
- B. Check flow characteristics and workability of fill as placement proceeds.
- C. Obtain at least three test cylinders for each placement area for determination of 56-day compressive strength and bleeding. Acceptance of placement will be based on average strength of three tests.
- D. Record volume of ballast together with flowable fill placement for same space to demonstrate that voids have been filled.

**.09 PROTECTION OF PERSONS AND PROPERTY**

- A. Provide safe working conditions as required by OSHA and applicable state and local laws for employees throughout demolition and removal operations. Observe safety requirements for work below grade.
- B. Maintain safe access to adjacent property and buildings. Do not obstruct roadways, sidewalks or passageways adjacent to work.

**END OF SECTION 15186**

## SECTION 15190

### AIR RELEASE AND VACUUM RELIEF VALVES

#### PART 1 GENERAL

##### .01 SCOPE

- A. Air release and vacuum relief valves.

##### .02 SUBMITTALS

- A. Conform to requirements of Section 01300 - Submittals.
- B. Submit manufacturer's product data for proposed valves for approval.

##### .03 QUALITY CONTROL

- A. Provide manufacturer's affidavit that air release and vacuum relief valves purchased for Work, were manufactured and tested in United States, and conform to requirements of this Section.

#### PART 2 PRODUCTS

##### .01 DESCRIPTION

- A. Provide combination air valves designed to fulfill functions of air release (permit escape of air accumulated in line at high point of elevation while line is under pressure) and vacuum relief.
- B. Provide inlet and outlet connections, and orifice as shown on Drawings.
- C. Valve exterior: Painted with shop-applied primer suitable for contact with potable water.

##### .02 MATERIALS

- A. Air Release Valves: Provide approved air release valves ASTM A 48, Class 30, cast iron; float and leverage mechanism with body and cover, ASTM A 240 or ASTM A 276 stainless steel; orifice and seat, stainless steel against Buna-N or Viton mechanically retained with hex head nut and bolt. Other valve internals shall be stainless steel or bronze.
- B. Air Release and Vacuum Relief Valves: Provide single-body, standard combination valves or duplex-body custom combination valves as indicated on Drawings.

1. For 2 inch and 3 inch, single-body valves, provide inlet and outlet size as shown on Drawings and orifice sized for 100 psi working pressure.
  - a. Valve materials: body, cover, and baffle, ASTM A 48, Class 35, or ASTM A 126, Grade B cast iron; plug or poppet, ASTM A 276 stainless steel; float, ASTM A 240 stainless steel; seat, Buna-N; other valve internals, stainless steel.
2. For 3 inch and larger duplex body valves as shown on Drawings, provide approved air release valve.
  - a. Air and vacuum valve materials: body and cover, ASTM A 48, Class 35, cast iron; float, ASTM A 240 stainless steel; seat, Type 304, stainless steel and Buna-N; other valve internals, stainless steel or bronze.
  - b. Air release valve: Constructed as specified in paragraph above on Air Release Valves.
- C. Vacuum Relief Valves: Provide approved air inlet vacuum relief valves with flanged inlet and outlet connections as shown on Drawings. Provide air release valves in combination with inlet and outlet, and orifice as shown on Drawings. Valve shall open under pressure differential not to exceed 0.25 psi.
1. Materials for vacuum relief valves: valve body, ASTM A 48, Class 35, cast iron; seat and plug, ASTM B 584 bronze, copper alloy 836; spring, ASTM A 313, Type 304, stainless steel; bushing, ASTM B 584 bronze, copper alloy 932; retaining screws, ASTM A 276, Type 304, stainless steel.
- D. Manholes: As shown on Drawings conforming to requirements of Section 02082 - Precast Concrete Manholes.

## PART 3 EXECUTION

### .01 SETTING VALVES IN MANHOLES AND VAULTS

- A. If required by AW Project Manager, provide services of technical representative of valve manufacturer available on site during installation of valves.
- B. Prior to installing valves, remove foreign matter from within valves. Inspect valves in open and closed position to verify that parts are in satisfactory working condition.
- C. Install valves and valve manholes and vaults where indicated on Drawings or as located by AW Project Manager. Set manholes and vaults plumb and as detailed. Center manholes on valves. Compact cement-stabilized sand around each manhole and vault for minimum radius of 4 feet, or to undisturbed trench face when less than 4 feet. Provide above-ground vents for manholes and vaults as indicated on Drawings.

.02 DISINFECTION AND TESTING

- A. Assist AW with disinfection of valves and appurtenances as required by Section 15020 - Disinfection of Watermains and test as required by Section 15030 – Pressure and Leakage Testing of Water Mains.

.03 PAINTING OF PIPING AND VALVES

- A. Paint piping and valves located in manholes, stations, and above ground using approved paint.

**END OF SECTION 15190**



## SECTION 15195

### WATER METERS

#### PART 1 GENERAL

##### .01 SCOPE

- A. Water meters, sub-meters, and fire service meters.

##### .02 SUBMITTALS

- A. Conform to requirements of Section 01300 - Submittals.
- B. Submit written certification of calibration and test results.
- C. Submit manufacturer's certification that water meters meet applicable requirements of this Specification Section.
- D. Submit accuracy registration test certification from manufacturer for each 3-inch through 10 inch diameter meter.

##### .03 QUALITY CONTROL

- A. Submit manufacturer's warranty against defects in materials and workmanship for one (1) year from date of Substantial Completion.
- B. Provide vendor's unconditional guarantee that performance of each meter meets applicable AWWA standards and AWWA Manual M6 as follows:

1. Displacement type: 10 years from installation or register registration shown below, whichever comes first.

Size (inch)	Registration (million gallons)
5/8,3/4	1.5
1	2.5
1-1/2	5.0
2	10.5

2. Turbine type: 1 year from date of installation.
3. Compound type: 1 year from date of installation.
4. Fire service type: 1 year from date of installation,

Operations of hermetically sealed register, 5/8-inch to 2-inch diameter, shall be unconditionally guaranteed for 15 years.

- C. Provide manufacturer's unconditional guarantee for each sealed register against leakage, fogging, discoloration and stoppage for 15 years from date of Installation.
- D. Vendor may replace meters that become defective within guarantee period with meters that comply with this Specification. AWS will return defective meters to vendor at expense. Meters repaired or replaced under this guarantee must meet accuracy limits for new meters upon receipt and accuracy limits for remaining period of initial guarantee.

#### .04 METER LOCATION REQUIREMENTS

- A. Install 2-inch and smaller water meters and shut-off valves (stop boxes) at point of demarcation or as close to point of demarcation as physically possible.
- B. Meters shall not be placed inside of government owned facilities. Meters located within buildings shall remain as government property and maintenance and operation of these meters shall remain the responsibility of the government.

### **PART2 PRODUCTS**

#### .01 GENERAL

- A. Provide meters of type and size as indicated on Drawings, unless otherwise indicated.
- B. Provide bolted split casings. Main casings of meters and external fasteners: Copper alloy with minimum 75 percent copper for 5/8 inch to 2 inches, bronze or cast iron, hot-dipped galvanized or epoxy coating for 3 inches and larger.
- C. Straightening Vanes: Non-corrosive material compatible with case material.
- D. Intermediate gear train shall not come into contact with water and shall operate in suitable lubricant.
- E. Registers: Automatic Meter Reading (AMR) type that provides pulse, contact closure, piezo switch or encoder generated output signal, compatible with AWS radio and telephone AMR systems. Provide minimum 12-foot wire when permanently connected to register. Lens:

impact resistant. Register box: tamper resistant by means of tamper screw or plug; Register: permanently sealed, straight-reading, center-sweep test hand, magnetic driven, U.S. gallons. Digits: 6, black in color, with lowest registering 3 digits (below 1,000-gallon registration) having contrasting digit and background color. Register capacity of meters: 9.99 million gallons for 5/8 inch to 2 inches and 999.999 million gallons for 3 inches and larger.

- F. Connections: 5/8 inch to 1 inch: threads at each end; 1-1/2 to 2 inches: 2-bolt oval flanges each end; 3 inches and larger: flange at each end.
- G. Stamp manufacturer's meter serial number on outer case. Stamp manufacturer's meter serial number on outside of register lid when provided. Manufacturer's serial numbers shall be individual and not duplicated.
- H. Water Meters:

1) Provide approved meters equipped with AMR type register to connect to American Water AMR system. Water Meters less than 1 ½" in size shall be: Neptune Model T10' (ProRead Gallon 6 wheel plastic bottom) with 'Neptune Model R900v2 – pit style MIU c/w 6-ft of antenna wire). **NO EXCEPTIONS**

Water Meter to be supplied with a 'McDonald' Cast Iron Yoke as shown on standard detail drawings for locations where directed by AW Project Manager.

2) Provide approved meters equipped with AMR type register to connect to American Water AMR system. Water Meters 1 ½" and greater shall be Neptune HP Turbine meters with 'Neptune Model R900i – pit style MIU c/w 6-ft of antenna wire). **NO EXCEPTIONS**

Water Meter to be supplied with a 'McDonald' meter setter as shown on standard detail drawings for locations where directed by AW Project Manager

- I. Manufacturing Quality Control shall permit successful interchangeability from one meter to another of same size including registers, measuring chambers and units, discs or pistons as units, change gears, bolts, nuts, and washers without affecting accuracy of new meter.
- J. For water meter vaults provide vaults in accordance with requirements set forth in Specification Section 03500 – Valve Boxes and Meter Vaults.

## .02 METER APPLICATIONS

A. Sizes 5/8-inch to 2-inch Meters: Displacement type (except for constant flow where 2-inch turbine may apply).

B. Sizes 3-inch and above Meters:

### 1. Turbines:

Processing plants  
Manufacturing facilities  
Lawn sprinkler systems  
Effluent water in treatment plants  
Booster (pump) stations  
Level controlled tank filling operations  
Fire hydrants (transients)  
Inter-systems sale or transfer  
Sewer credit/sub-meter

### 2. Compounds:

Multi-family dwellings  
Motels and hotels  
Hospitals  
Schools  
Restaurants  
Office buildings  
Dormitories, nursing homes, department stores, shopping malls, and other commercial establishments

Note: Provide fire service type for sizes larger than 6 inches.

3. Fire Service Type: For designated fire protection lines. Provide proportional or compound type fire service meter assembly (AWWA C 703) when customer elects to use combination of potable and fire protection services in lieu of separate domestic meters and fire services.

## .03 MATERIALS

A. Cold-Water Meters:

1. Displacement Type: AWWA C 700; sizes 5/8 inch up to and including 2 inches; oscillating disc or piston of magnetic drive type; bolted split-case design, with either being removable.

2. Turbine Type: AWWA C 701; Class II; sizes 3 inches through 10 inches; flanged; straight-through measuring chamber; rotor construction: polypropylene or similar non rubber material with specific gravity of approximately 1.0, equipped with near frictionless replaceable bearings in turbine working against rotor shaft positioned thrust bearing. Transient/Fire Hydrant Meter Inlet: Female fitting for attachment to hose nozzle with National Standard Fire hose thread. Outlet: 2-inch nipple with National Pipe Thread. Include restriction plate to limit flow through meter to 400 gpm at 65 psi.
3. Compound Type: AWWA C 702; sizes 2 inches through 6 inches. Measuring chambers: For use in continuous operation; separate units of copper alloy (minimum 84 percent copper) or approved polymer material, inert in corrosive potable water; with centering device for proper positioning. Measuring pistons: Non-pilot type with division plates of rubber covering vulcanized to stainless steel or other approved material of sufficient thickness to provide minimum piston oscillation noise. Measuring discs: Flat or conical type, one piece, mounted on monel or 316 stainless steel spindle. Measuring chamber strainer screen area: Twice area of main case inlet.
4. Fire-Service Type: sizes 4 inches through 10 inches; turbine-type, compound type, proportional type; AWWA C 703, with separate check valve conforming to AWWA C 510. Determine size of fire meter by adding fire flow and domestic flow.

#### .04 STRAINERS

- A. Displacement Potable Water Meters 5/8 inch through 2 inches: Self-straining by means of annular space between measuring chamber and external case or with strainer screens installed in meter. Provide rigid screens which fit snugly, are easy to remove, with effective straining area at least double that of main case inlet.
- B. Potable Water Meters 2-inch diameter and larger: Equip with separate external strainer with bronze body for diameters less than 8 inches. 8-inch diameter and larger may be cast iron, hot-dipped galvanized or epoxy coating. Strainers: Bolted to inlet side of meter, detachable from meter, easily removable lid. Strainer screen: Made of rounded cast bronze, stainless steel wire, having nominal screen size of 3-1/2 mesh-per-inch (U.S. Series) not less than 45 percent clear area.
- C. Provide separate approved external strainers (when required by meter manufacturer) approved for use in fire service metered connections by Underwriters Laboratories. Bodies: Cast iron or copper alloy. Ends:

Flanged in accordance with ASME B 16.1, Class 125. Provide stainless steel basket. Strainers shall be detachable from meter.

#### .05 CONNECTIONS AND FITTINGS

- A. Provide pipe for connections in accordance with Section 02501 - Ductile Iron Pipe and Fittings and Section 02506 - Polyvinyl Chloride Pipe. Use restrained joints and flanged joints only.
- B. Fittings:
  - 1. For meters 2 inches and smaller: Same type of fittings as Outlet End fittings for Curb Stop in accordance with Section 15050 - Water Tap and Service Line Installation.
  - 2. For meters 3 inches and larger: Restrained ductile iron; push-on bell joints or mechanical joint fittings between water line and meter vault; Class 125 flanged inside meter vaults; cement mortar lined and sealed.

#### .06 LAYING LENGTHS

- A. Minimum laying lengths for meter and standard strainer shall be as shown on Drawings.

### **PART 3 EXECUTION**

#### .01 TAPPING AND METER SERVICE INSTALLATION

- A. Meter Service Line:
  - 1. Use pipe and fittings conforming to requirements of Section 15105 - Ductile Iron Pipe and Fittings, or Section 15120 - Polyvinyl Chloride Pipe.
  - 2. Limit pulling and deflecting of joints to limits recommended by manufacturer.
  - 3. Make vertical adjustments with offset bends where room will permit. Minimize number of bends.
  - 4. Provide minimum of ten pipe diameters of straight pipe length upstream and downstream of meter vault.

## .02 METER FITTING HOOKUP

- A. Support meter piping and meter, level and plumb, during installation. Support meters 3 inches and larger with concrete at minimum of two locations.
- B. Use round flanged fittings inside meter box or vault except for mechanical joint to flange adapter. Provide full-face 1/8-inch black neoprene or red rubber gasket material on flanged joints. Provide bolts and nuts made from approved corrosion-resistant material.
- C. Tighten bolts in proper sequence and to correct torque.
- D. Visually check for leaks under normal operating pressure following installation. Repair or replace leaking components.

## .03 METER BOX AND VAULT INSTALLATION

- A. Conform to requirements of Section 03500 - Valve Boxes and Meter Vaults.
- B. Perform adjustment to existing meter in accordance with Section 03500 - Valve Boxes and Meter Vaults.

## .04 TESTING

- A. Accuracy registration tests will be conducted in accordance with latest revision of AWWA standard for type and size of meter.
  - 1. Tests will be run by on meters prior to installation at AWS meter repair shop. Meters 2 inches and smaller will be tested at random at AWS discretion. All 3 inches and larger meters will be tested.



2. Accuracy of displacement meters during guarantee period shall be as follows:

- a. Initial period: of 18 months from date of shipment or 12 months from date of installation: 98.5% to 101.5% at standard and minimum flow rates; 98% to 101% at low flow rates.
- b. Second period: AWWA new meter accuracy as tested below.

Meter Size (inches)	<u>GUARANTEE PERIOD</u>		<u>TEST FLOW RATE</u>
	Age of Meter (Years) Or	Million* Gallons	Minimum Rate (gpm)
5/8	>1 to <5	0.5	1/4
1	>1 to <5	1.0	3/4
1-1/2	>1 to <5	2.5	1-1/2
2	>1 to <5	5.5	2

\* Total registration.

- c. Third period: AWWA new meter accuracy for standard flow rates and AWWA repair meter accuracy for minimum flow rate as tested below.

Meter Size (inches)	<u>GUARANTEE PERIOD</u>		<u>TEST FLOW RATE</u>
	Age of Meter (Years) Or	Million* Gallons	Minimum Rate (gpm)
5/8	>5 to <10	1.5	1/4
1	>5 to <10	2.5	3/4
1-1/2	>5 to <10	5.0	1-1/2
2	>5 to <10	10.0	2

3. Minimal acceptable accuracy in percent of low flow registration for turbine meters:

<u>Meter Size</u> <u>(inches)</u>	<u>Minimum Flow</u> <u>(gpm)</u>	<u>% Accuracy</u> <u>Required</u>
2	3	95
3	5	95
4	15	95
6	20	95
8	20	95
10	30	95

**END OF SECTION 15195**



## SECTION 15200

### GRAVITY SANITARY SEWERS

#### PART 1 GENERAL

##### .01 SCOPE

- A. Gravity sanitary sewers and appurtenances, including stacks and service connections.

##### .02 SUBMITTALS

- A. Conform to requirements of Section 01300 Submittals.
- B. Submit proposed methods, equipment, materials and sequence of operations for sewer construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.
- C. Test Reports: Submit test reports and inspection videos as specified in Part 3 of this Section. Video tapes become property of AW.

##### .03 QUALITY ASSURANCE

- A. Qualifications. Install sanitary sewer that is watertight both in pipe-to-pipe joints and in pipe-to-manhole connections. Perform testing in accordance with Section 15250 - Acceptance Testing for Sanitary Sewers.
- B. Regulatory Requirements.
  - 1. Install sewer lines to meet minimum State mandated separation distance from potable water line, as scheduled below. Separation distance is defined as distance between outside of water pipe and outside of sewer pipe. Install new sanitary sewers no closer to water lines than 10 feet in all horizontal directions. Where water and sanitary sewer lines cross, a minimum of 2 feet of vertical separation is required when the water line passes above the sanitary sewer main. Where separation distance cannot be achieved, sanitary sewers shall be constructed of ductile iron sanitary sewer piping or encased in reinforced concrete encasement (as detailed on the plans) for a minimum distance of 10 feet either side of the crossing.
  - 2. Make notification to AW Project Manager when water lines are uncovered during sanitary sewer installation where minimum separation distance cannot be maintained.
  - 3. Lay gravity sewer lines in straight alignment and grade.

#### .04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Inspect pipe and fittings upon arrival of materials at job site.
- B. Handle and store pipe materials and fittings to protect them from damage due to impact, shock, shear or free fall. Do not drag pipe and fittings along ground. Do not roll pipe unrestrained from delivery trucks.
- C. Use mechanical means to move or handle pipe. Employ acceptable clamps, rope or slings around outside barrel of pipe and fittings. Do not use hooks, bars, or other devices in contact with interior surface of pipe to lift or move lined pipe.

### PART 2 PRODUCTS

#### .01 PIPE

- A. Provide piping materials for gravity sanitary sewers of sizes and types indicated on Drawings or as specified.
- B. Unlined reinforced concrete pipe is not acceptable.
- C. All gravity sewer at Fort Leavenworth shall be SDR 26 PVC or better. SDR 35 pipe shall not be accepted at this location.

#### .02 PIPE MATERIAL SCHEDULE

- A. Unless otherwise shown on Drawings, use pipe materials that conform to requirements specified in one or more of following Sections:
  - 1. Section 15105 - Ductile Iron Pipe and Fittings.
  - 2. Section 15120 - Polyvinyl Chloride Pipe.
- B. Where shown on Drawings, provide pipe meeting minimum class, dimension ratio, or other criteria indicated.
- C. Pipe materials other than those listed above shall not be used for gravity sanitary sewers.

#### .03 APPURTENANCES

- A. Stacks. Conform to requirements of Section 15260 - Sanitary Sewer Service Stubs.
- B. Service Connections. Conform to requirements of Section 15260 - Sanitary Sewer Service Stubs.
- C. Roof, street or other type of surface water drains shall not be connected or reconnected into sanitary sewer lines.

#### .04 BEDDING AND BACKFILL MATERIAL

- A. Bedding and Backfill: Conform to requirements of Section 02317 - Excavation and Backfill for Utilities and Section 02320 - Utility Backfill Materials.

### PART 3 EXECUTION

#### .01 PREPARATION

- A. Prepare traffic control plans and set up street detours and barricades in preparation for excavation when construction will affect traffic. Conform to requirements of Traffic Control and Regulation.
- B. Provide barricades, flashing warning lights, and warning signs for excavations. Conform to requirements of Traffic Control and Regulation. Maintain barricades and warning lights where work is in progress or where traffic is affected.
- C. Perform work in accordance with OSHA standards. Employ trench safety system for excavations over 5 feet deep.
- D. Immediately notify agency or company owning utility line which is damaged, broken or disturbed. Obtain approval from AW Project Manager and agency or utility company for repairs or relocations, either temporary or permanent.
- E. Remove old pavements and structures including sidewalks and driveways in accordance with requirements of Section 02614 – Curbs, Driveways, and Sidewalks.
- F. Install and operate dewatering and surface water control measures in accordance with contract document requirements.
- G. Do not allow sand, debris or runoff to enter sewer system.

#### .02 DIVERSION PUMPING

- A. All diversion and bypass pumping shall be performed in accordance with Section 15290 – Pumping and Bypassing.

#### .03 EXCAVATION

- A. Earthwork. Conform to requirements of Section 02317 - Excavation and Backfill for Utilities. Use bedding as indicated on Drawings.
- B. Line and Grade. Establish required uniform line and grade in trench from benchmarks identified by AW Project Manager. Maintain this control for minimum of 100 feet behind and ahead of pipe-laying operation. Use laser

beam equipment to establish and maintain proper line and grade of work. Use of appropriately sized grade boards which are substantially supported is also acceptable. Protect boards and location stakes from damage or dislocation.

- C. Trench Excavation. Excavate pipe trenches to depths shown on Drawings and as specified in Section 02317 - Excavation and Backfill for Utilities.

#### .04 PIPE INSTALLATION BY OPEN CUT

- A. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.
- B. Install pipe only after excavation is completed, bottom of trench fine graded, bedding material is installed, and trench has been approved by Project Manager.
- C. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment indicated. Provide bell holes where necessary.
- D. Install pipe with spigot ends toward downstream end of flow such that water flows into bell and out the spigot.
- E. Form concentric joint with each section of adjoining pipe so as to prevent offsets.
- F. Keep interior of pipe clean as installation progresses. Remove foreign material and debris from pipe
- G. Provide lubricant, place and drive home newly laid sections with come-a-long winches so as to eliminate damage to sections. Install pipe to "home" mark where provided. Use of back hoes or similar powered equipment will not be allowed unless protective measures are provided and approved in advance by Project Manager.
- H. Keep excavations free of water during construction and until final inspection.
- I. When work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material from entering pipe.
- J. Where gravity sanitary sewer is to be installed underexisting water line with separation distance of less than 2 feet, construct new sewer pipe so that 20 feet of ductile iron pipe is centered on water line crossing or encase the sewer line with reinforced concrete encasement as detailed on the plans. If gravity sanitary sewer is to be installed above existing water line, construct new sewer pipe so that 20 feet of ductile iron pipe is centered on water line crossing or encase the sewer line with reinforced concrete encasement. .

- K. Where gravity sanitary sewer is to be installed under existing water line, install new sewer using ductile iron or encased in reinforced concrete encasement as shown on Drawings. Maintain minimum 2-foot separation distance.
- L. Where the length of the stub is not indicated, install the stub to the right-of-way line and seal the free end with an approved plug.

#### .05 PIPE INSTALLATION OTHER THAN OPEN CUT

- A. For installation of pipe by augering, jacking, or tunneling, conform to requirements of specification sections on tunneling augering, jacking and microtunneling work as appropriate.

#### .06 INSTALLATION OF APPURTENANCES

- A. Service Connections. Install service connections to conform to requirements of Section 15260- Sanitary Sewer Service Stubs.
- B. Stacks. Construct stacks to conform to requirements of 15260- Sanitary Sewer Service Stubs.
- C. Construct manholes to conform to requirements of Section 03450 - Precast Concrete Manholes.

#### .07 INSPECTION AND TESTING

- A. Visual Inspection: Check pipe alignment in accordance with Section 15250 - Acceptance Testing for Sanitary Sewers.
- B. Mandrel Testing. Use Mandrel Test to test flexible pipe for deflection. Refer to Section 15250 - Acceptance Testing for Sanitary Sewers.
- C. Pipe Leakage Test. After backfilling line segment and prior to tie-in of service connections, visually inspect gravity sanitary sewers where feasible, and test for leakage in accordance with Section 15250 - Acceptance Testing for Sanitary Sewers.

#### .08 BACKFILL AND SITE CLEANUP

- A. Backfill and compact soil in accordance with Section 02317 - Excavation and Backfill for Utilities.
- B. Backfill trench in specified lifts only after pipe installation is approved by Project Manager.
- C. Repair and replace removed or damaged pavement, curbs, gutters, and sidewalks as specified in Section 02614 – Curbs, Driveways, and Sidewalks.

- D. Provide hydromulch seeding in areas of commercial, industrial or undeveloped land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil as specified in Section 02911 - Topsoil and apply hydromulch according to requirements of Section 02921 - Hydromulch Seeding.
- E. Provide sodding in areas of residential land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on Drawings. Restore disturbed lawn areas in accordance with Section 02820 – Lawn Restoration.

#### .09 POST-INSTALLATION TELEVISION INSPECTION

- A. Prior to final acceptance of newly constructed gravity sanitary sewers, perform cleaning and closed circuit television inspection. Cleaning shall include utilizing variable pressure water nozzles (3000 psi) and collection, removal, transportation and disposal of sand, debris, and liquid wastes to legal disposal sites.
- B. Select and use closed-circuit television equipment that will produce color video tape. Produce video tape using pan-and-tilt, radial viewing, pipe inspection camera that pans plus and minus 275 degrees and rotates 360 degrees. Use camera with accurate footage counter which displays on monitor exact distance of camera from starting manhole. Use camera with camera height adjustment so that camera lens is always centered at one-half inside diameter, or higher, in pipe being televised. Provide lighting system that allows features and condition of pipe to be clearly seen. Reflector in front of camera may be necessary to enhance lighting in dark or large diameter pipe.
- C. Perform television inspection of gravity sanitary sewers as follows:
  - 1. Videos shall pan beginning and ending manholes to demonstrate that debris has been removed. Camera operator shall slowly pan each service connection and where sewer transitions from one pipe material to another.
  - 2. Video shall be continuous for pipe segments between manholes. Do not leave gaps in video taping of segment between manholes and do not show single segment on more than one video tape.
  - 3. No flow is allowed in gravity sanitary sewer while performing post-installation television inspection.
- D. Provide video tapes in DVD format, recorded at Standard Play (SP). Labels are required. Place one label on jewel case and other on face of DVD. Permanently label each video with following information.



### Spine of Tape

Wastewater File No.: _____ Contractor's Name: Inspection Type: <input type="checkbox"/> Survey <input type="checkbox"/> Pre-Installation <input type="checkbox"/> Post-Installation Tape No.: _____ Date Televised: _____ Date Submitted: Basin No: _____
--

### Face of Tape

Manhole No. From	Manhole No. To	Pipe Diameter	Pipe Length	Street
_____	_____	_____	_____	
_____	_____	_____	_____	
_____	_____	_____	_____	
_____	_____	_____	_____	
_____	_____	_____	_____	

- E. For each video provide completed TV Inspection Report. TV Inspection Report is written/narrated log of pipe conditions and service connections, indexed to footage counter.
- F. Upon completion of video reviews by AW Project Manager, Contractor will be notified regarding final acceptance of sewer segment.

**END OF SECTION 15200**



## SECTION 15210

### SANITARY SEWER FORCE MAINS

#### PART 1 GENERAL

##### .01 SCOPE

- A. Sanitary sewer forcemains.

##### .02 SUBMITTALS

- A. Conform to requirements of Section 01300 - Submittals.
- B. Submit proposed methods, equipment, materials, and sequence of operations for force main construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.
- C. Force mains 24 inches in diameter and larger: Submit shop drawings and design calculations for joint restraint systems using reinforced concrete encasement of pressure pipe and fittings.
- D. Submit qualifications, proposed methods, equipment, materials, and sequence for acceptance testing of pipeline. Submit evidence of experience with pipeline proving by pigging for at least three projects of equal or greater scope; project list shall include dates, size and length of pipe, location, owner name, contact person, and telephone number. Provide certificate of training by manufacturer of pigging equipment being used.
- E. Submit test reports as specified in Part 3 of this Section.

#### PART 2 PRODUCTS

##### .01 PIPE AND FITTING MATERIAL SCHEDULE

- A. Unless otherwise shown on Drawings, use pipe materials that conform to requirements specified in one or more of the following Sections:
  - 1. Section 15105 - Ductile-Iron Pipe and Fittings.
  - 2. Section 15125 - High Density Polyethylene Pipe (HDPE).
  - 3. Section 15120 - Polyvinyl Chloride Pipe. Provide Lined Ductile-Iron Fittings in Accordance with Section 15105- Ductile-Iron Pipe and Fittings.



## .02 THRUST RESTRAINT

- A. Unless otherwise shown on Drawings, provide concrete thrust blocking for force mains up to 12-inches in diameter, to prevent movement of buried lines under pressure at bends, tees, caps, valves and hydrants. Blocking shall be Portland cement concrete, as specified in Concrete for Utility Construction. Place concrete in accordance with details on Drawings. Place thrust blocks between undisturbed ground and fittings. Anchor fittings to thrust blocks so that pipe and fitting joints are accessible for repairs. Concrete shall extend from 6 inches below pipe or fitting to 12 inches above.
- B. For forcemains larger than 12 inches in diameter, and where indicated on Drawings, provide restrained joints conforming to requirements of force main pipe material specifications. Install restrained joints for length of pipe on both sides of each bend or fitting for full length shown on Drawings.
- C. Horizontal and vertical bends between zero and 10 degrees deflection angle will not require thrust blocks or harnessed or restrained joints.
- D. Horizontal and vertical bends between 10 degrees and 90 degrees deflection angle shall have thrust restraint as shown on Drawings.
- E. Provide thrust restraint at tees, plugs, blowoff drains, valves, and caps, as indicated.
- F. Reinforced concrete encasement of force main pipe and fittings may be used in lieu of manufactured joint restraint systems. Alternate joint restraint systems using reinforced concrete encasement shall conform to following design requirements.
  - 1. Design calculations shall be performed and sealed by Professional Engineer licensed in the State where the project is being completed.
  - 2. Base design calculations upon soil parameters quantified in geotechnical report for site where alternative thrust restraint system is to be installed. When data is not available for site, use parameters recommended by geotechnical engineer.
  - 3. The design system pressure shall be specified test pressure.
  - 4. The following safety factors shall be used in sizing restraint system:
    - a. Apply factor of safety equal to 1.5 for passive soil resistance.
    - b. Apply factor of safety equal to 2.0 for soil friction.
  - 5. Contain encasement entirely within standard trench width and terminate on both ends at pipe bell or coupling.
  - 6. Concrete encasement reinforcement steel shall be designed for all loads, including internal pressure and longitudinal forces. Concrete design shall be in accordance with ACI 318.

## PART 3 EXECUTION

### .01 PIPE INSTALLATION BY OPEN-CUT

- A. Perform excavation, bedding, and backfill in accordance with Section 02317 - Excavation and Backfill for Utilities.
- B. Wrap ductile-iron pipe and fittings with polyethylene wrap in accordance with requirements of Section 15130 - Polyethylene Wrap. Do not install polyethylene wrap on ductile iron pipe protected by cathodic protection system or fusion bonded or polyurethane coated fittings.
- C. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.
- D. Install pipe only after excavation is completed, bottom of trench is fine graded, bedding material is installed, and trench has been approved by Project Manager.
- E. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment indicated. Provide bell holes where necessary.
- F. Install pipe with spigot ends toward direction of flow. Form concentric joint with each section of adjoining pipe so as to prevent offsets.
- G. Keep interior of pipe clean as installation progresses. Where cleaning after laying pipe is difficult because of small pipe size, use suitable swab or drag in pipe and pull it forward past each joint immediately after joint has been completed. Remove foreign material and debris from pipe.
- H. Provide lubricant, place and drive home newly-laid sections with come-a-long winches so as to eliminate damage to sections. Install pipe to "home" mark where provided. Use of back - hoes or similar powered equipment will not be allowed unless protective measures are provided and approved in advance by AW Project Manager.
- I. Keep excavations free of water during construction and until final inspection.
- J. When work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material from entering pipe.
- K. Where sanitary sewer force main is to be installed under existing water line with separation distance of less than 2 feet, install one full joint length of pipe, minimum 18 foot length, centered on water line and maintain minimum 6-inch separation distance.

## .02 PIPE INSTALLATION OTHER THAN OPEN-CUT

- A. For installation of pipe by augering, jacking, or tunneling, conform to requirements of specification section of augering or tunneling work.

## .03 HYDROSTATIC TESTING

- A. After pipe and appurtenance have been installed, test line and drain. Prevent damage to Work or adjacent areas. Use clean water to perform tests.
- B. Project Manager may direct tests of relatively short sections of completed lines to minimize traffic problems or potential public hazards.
- C. Test pipe in presence of AW Project Manager.
- D. Test pipe at 150 psig or 1.5 times design pressure of pipe, whichever is greater. Design pressure of force main shall be rated total dynamic head of lift station pump.
- E. Test pipe at required pressure for minimum of 2 hours according to requirements of UNI-B-3.
- F. Maximum allowable leakage shall be as calculated by following formula:

$$L = (S) (D) (P^{0.5}) / 133,200$$

Where: L = Leakage in gallons per hour.

S = Length of pipe in feet.

P = Inside diameter of pipe in inches.

D = Pressure in pounds per square inch.

- G. Correct defects, cracks, or leakage by replacement of defective items or by repairs as approved by AW Project Manager.
- H. Plug openings in force main after testing and flushing. Use cast iron plugs or blind flanges to prevent debris from entering tested pipeline.

## .04 PIGGING TEST

- A. After completion of hydrostatic testing and prior to final acceptance, test force mains longer than 200 feet by pigging to ensure piping is free of obstructions.
- B. Pigs: Provide proving pigs manufactured of open-cell polyurethane foam body, without coating or abrasives which would scratch or otherwise damage interior pipe wall surface or lining. Pigs shall be able to pass through reductions of up to 65 percent of nominal crosssectional area of pipe. Pigs shall be able to pass through standard fittings such as 45-

degree and 90-degree elbows, crosses, tees, wyes, gate valves, or plug valves, as applicable to force main being tested.

- C. Test Execution: Conduct pigging test in presence of AW Project Manager. Provide at least 48 hours notice of scheduled pigging of force main prior to commencing test.

**END OF SECTION 15210**

## SECTION 15250

### ACCEPTANCE TESTING FOR SANITARY SEWERS

#### PART 1 GENERAL

##### .01 SECTION INCLUDES

- A. Acceptance testing of sanitary sewers including:
  - 1. Visual inspection of sewer pipes
  - 2. Mandrel testing for flexible sewer pipes.
  - 3. Leakage testing of sewer pipes.
  - 4. Leakage testing of manholes.
  - 5. Smoke testing of point repairs.
  - 6. Television of sewer lines.
- B. All tests listed in this Section are not necessarily required on this Project. Required tests are named in other Sections which refer to this Section for testing criteria and procedures.

##### .02 PERFORMANCE REQUIREMENTS

- A. Gravity flow sanitary sewers are required to have straight alignment and uniform grade between manholes.
- B. Flexible pipe, including "semi-rigid" pipe, is required to show no more than 5 percent deflection. Test pipe no sooner than 30 days after backfilling of line segment but prior to final acceptance using standard mandrel to verify that installed pipe is within specified deflection tolerances.
- C. Maximum allowable leakage for Infiltration or Exfiltration
  - 1. The total exfiltration, as determined by hydrostatic head test, shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours at minimum test head of 2 feet above crown of pipe at upstream manhole or 2 feet above groundwater elevation, whichever is greater.
  - 2. When pipes are installed more than 2 feet below groundwater level, use infiltration test in lieu of exfiltration test. Total infiltration shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours. Groundwater elevation must be at least 2 feet above crown of pipe at upstream manhole.
  - 3. Refer to Table 15250-1, Water Test Allowable Leakage, at end of Section,

for measuring leakage in sewers. Perform leakage testing to verify that leakage criteria are met.

- D. Perform air testing in accordance with requirements of this Section and the local state environmental agency requirements. Refer to Table 15250-2, Time Allowed for Pressure Loss from 3.5 psig to 2.5 psig, Table 15250-3, Minimum Testing Times for Low Pressure Air Test, and Table 15250-4, Vacuum Test Time Table, at end of this Section.
- E. Perform video televising of all in-place mains.

### .03 SUBMITTALS

- A. Conform to requirements of Section 01300 - Submittals.
- B. Test Plan: Before testing begins and in adequate time to obtain approval through submittal process, prepare and submit test plan for approval by AW Project Manager. Include testing procedures, methods, equipment, and tentative schedule. Obtain advance written approval for deviations from Drawings and Specifications.
- C. Test Reports: Submit test reports for each test on each segment of sanitary sewer.
- D. Video television records shall be provided on DVD medium.

### .04 GRAVITY SANITARY SEWER QUALITY ASSURANCE

- A. Repair, correct, and retest manholes or sections of pipe which fail to meet specified requirements when tested.
- B. Provide testing reports and video of television inspection as directed by Project Manager.
- C. Upon completion of video televising reviews by AW Project Manager, Contractor will be notified regarding final acceptance of sewer segment.

### .05 SEQUENCING AND SCHEDULING

- A. Perform testing as work progresses. Schedule testing so that no more than 1000 linear feet of installed sewer remains untested at one time.
- B. Coordinate testing schedules with AW Project Manager. Perform testing under observation of AW Project Manager.

### .06 TELEVISION INSPECTION

- A. Quality Assurance: Submit one example video dvd of previous sewer inspection work that shows operational and structural defects in sewers, complete with audio commentary and inspection log(s).

1. Video and inspection logs will be reviewed to determine if quality of CCTV image is acceptable, and if defects were properly identified and documented.
  2. Modify equipment and/or inspection procedures to achieve report material of acceptable quality.
  3. Do not commence Work prior to approval of report by AW project manager.
- B. Inspection Logs: Unless otherwise indicated, submit inspection logs that include the following as a minimum:
1. Project title
  2. Name of American Water Enterprises Inc.
  3. Time of day
  4. System map number
  5. Manhole to manhole pipe section
  6. Pipe segment length
  7. Pipe material
  8. Line size
  9. Compass direction of viewing
  10. Direction of camera's travel
  11. Pipe depth
  12. Operator name
  13. Tape counter reading at beginning and end of each manhole to manhole pipe segment.
- C. Video DVD's: Submit completed video DVD's after cleaning and rehabilitation.
- D. Maintain copy of all inspection documentation (DVD's, databases, and logs) for duration of Work and warranty period.

## PART 2 PRODUCTS

### .01 DEFLECTION MANDREL

- A. Mandrel Sizing. Rigid mandrel shall have outside diameter (O.D.) equal to 95 percent of inside diameter (I.D.) of pipe. Inside diameter of pipe, for purpose of determining outside diameter of mandrel, shall be average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and average inside diameter for I.D. controlled pipe, dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.
- B. Mandrel Design. Rigid mandrel shall be constructed of metal or rigid plastic material that can withstand 200 psi without being deformed. Mandrel shall have nine or more "runners" or "legs" as long as total number of legs is odd number. Barrel section of mandrel shall have length

of at least 75 percent of inside diameter of pipe. Rigid mandrel shall not have adjustable or collapsible legs which would allow reduction in mandrel diameter during testing. Provide and use proving ring for modifying each size mandrel.

- C. Proving Ring. Furnish "proving ring" with each mandrel. Fabricate ring of 1/2-inch-thick, 3-inch-wide bar steel to diameter 0.02 inches larger than approved mandrel diameter.
- D. Mandrel Dimensions (5 percent allowance). Average inside diameter and minimum mandrel diameter are specified in Table 15250-5, Pipe vs. Mandrel Diameter, at end of this Section. Mandrels for higher strength, thicker wall pipe or other pipe not listed in table may be used when approved by Project Manager.

## .02 EXFILTRATION TEST

- A. Test Equipment:
  - 1. Pipe plugs.
  - 2. Pipe risers where manhole cone is less than 2 feet above highest point in pipe or service lead.

## .03 INFILTRATION TEST

- A. Test Equipment:
  - 1. Calibrated 90 degree V-notch weir.
  - 2. Pipe plugs.

## .04 LOW PRESSURE AIR TEST

- A. Minimum Requirement for Equipment:
  - 1. Control panel
  - 2. Low-pressure air supply connected to control panel.
  - 3. Pneumatic plugs: Acceptable size for diameter of pipe to be tested; capable of withstanding internal test pressure without leaking or requiring external bracing.
  - 4. Air hoses from control panel to:
    - a. Air supply.
    - b. Pneumatic plugs.
    - c. Sealed line for pressuring.
    - d. Sealed line for monitoring internal pressure.



- B. Testing Pneumatic Plugs: Place pneumatic plug in each end of length of pipe on ground. Pressurize plugs to 25 psig; then pressurize sealed pipe to 5 psig. Plugs are acceptable when they remain in place against test pressure without external aids.

#### .05 GROUND WATER DETERMINATION

- A. Equipment: Pipe probe or small diameter casing for ground water elevation determination.

#### .06 SMOKE TESTING

- A. Equipment:
  - 1. Pneumatic plugs.
  - 2. Smoke generator as supplied by Superior Signal Company, or approved equal.
  - 3. Blowers producing 2500 scfm minimum.

#### .07 TELEVISION INSPECTION MATERIALS AND EQUIPMENT

- A. DVD: Standard size medium usable in laptop and television DVD players.
  - 1. Audio portion of composite DVD shall be sufficiently free from electrical interference and background noise to provide complete intelligibility of oral report.
  - 2. Identify each tape with tape labels showing SNL's name, Contractor's name, and each manhole-to-manhole pipe segment of sewer line represented on tape.
- B. Television Inspection Camera(s): Equipped with rotating head, capable of 90-degree rotation from horizontal and 360-degree rotation about its centerline.
  - 1. Minimum Camera Resolution: 400 vertical lines and 460 horizontal lines.
  - 2. Camera Lens: Not less than 140 degree viewing angle, with automatic or remote focus and iris controls.
  - 3. Focal Distance: Adjustable through range of 6 inches (152 mm) to infinity.
  - 4. Camera(s) shall be intrinsically safe and operative in 100 percent humidity conditions.
  - 5. Lighting Intensity: Remote-controlled and adjusted to minimize reflective glare.

- 6. Lighting and Camera Quality: Provide clear, in-focus picture of entire inside periphery of sewer.
- C. Footage Counter: Measures distance traveled by camera in sewer, accurate to plus or minus 2 feet (0.6 m) in 1,000 feet (305 m).
- D. Video Titling: Video equipment shall include genlocking capabilities to extent that computer generated data (such as footage, date, and size) as determined by SDR, can be overlaid onto video, and be indicated on television monitor and permanently recorded on inspection DVD..

## **PART 3 EXECUTION**

### **.01 PREPARATION**

- A. Provide labor, equipment, tools, test plugs, risers, air compressor, air hose, pressure meters, pipe probe, calibrated weirs, or any other device necessary for proper testing and inspection.
- B. Determine selection of test methods and pressures for gravity sanitary sewers based on ground water elevation. Determine ground water elevation using equipment and procedures conforming to Control of Ground Water and Surface Water.

### **.02 VISUAL INSPECTION OF GRAVITY SANITARY SEWERS**

- A. Check pipe alignment visually by flashing light between structures. Verify if alignment is true and no pipes are misplaced. In case of misalignment or damaged pipe, remove and relay or replace pipe segment.

### **.03 MANDREL TESTING FOR GRAVITY SANITARY SEWERS**

- A. Perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than 5 percent deflection. Mandrel testing shall conform to ASTM D 3034. Perform testing no sooner than 30 days after backfilling of line segment, but prior to final acceptance testing of line segment.
- B. Pull approved mandrel by hand through sewer sections. Replace any section of sewer not passing mandrel. Mandrel testing is not required for stubs.
- C. Retest repaired or replaced sewer sections.

### **.04 LEAKAGE TESTING FOR GRAVITY SANITARY SEWERS**

- A. Test Options:
  - 1. Test gravity sanitary sewer pipes for leakage by either exfiltration or infiltration methods, as appropriate, or with low pressure air testing.

2. Test new or rehabilitated sanitary sewer manholes with water or low pressure air. Manholes tested with low pressure air shall undergo physical inspection prior to testing.
  3. Perform leakage testing after backfilling of line segment, and prior to tie-in of service connections.
  4. If no installed piezometer is within 500 feet of sewer segment, provide temporary piezometer for this purpose.
- B. Compensating for Ground Water Pressure:
1. Where ground water exists, install pipe nipple at same time sewer line is placed. Use 1/2-inch capped pipe nipple approximately 10 inches long. Make installation through manhole wall on top of sewer line where line enters manhole.
  2. Immediately before performing line acceptance test, remove cap, clear pipe nipple with air pressure, and connect clear plastic tube to nipple. Support tube vertically and allow water to rise in tube. After water stops rising, measure height in feet of water over invert of pipe. Divide this height by 2.3 feet/psi to determine ground water pressure to be used in line testing.
- C. Exfiltration test:
1. Determine ground water elevation.
  2. Plug sewer in downstream manhole.
  3. Plug incoming pipes in upstream manhole.
  4. Install riser pipe in outgoing pipe of upstream manhole when highest point in service lead (house service) is less than 2 feet below bottom of manhole cone.
  5. Fill sewer pipe and manhole or pipe riser, when used, with water to point 2-1/2 feet above highest point in sewer pipe, house lead, or ground water table, whichever is highest.
  6. Allow water to stabilize for one to two hours. Take water level reading to determine drop of water surface, in inches, over one-hour period, and calculate water loss (1 inch of water in 4 feet diameter manhole equals 8.22 gallons) or measure quantity of water required to keep water at same level. Loss shall not exceed that calculated from allowable leakage according to Table 15250-1 at end of this Section.
- D. Infiltration test: Ground water elevation must be not less than 2.0 feet above highest point of sewer pipe or service lead (house service).
1. Determine ground water elevation.
  2. Plug incoming pipes in upstream manhole.

3. Insert calibrated 90 degree V-notch weir in pipe on downstream manhole.
  4. Allow water to rise and flow over weir until it stabilizes.
  5. Take five readings of accumulated volume over period of 2 hours and use average for infiltration. Average must not exceed that calculated for 2 hours from allowable leakage according to Table 15250-1 at end of this Section.
- E. Low Air Pressure Test: When using this test conform to ASTM C 828, ASTM C 924, or ASTM F 1417, as applicable, with holding time not less than that listed in Table 15250-2.
1. Air testing for sections of pipe shall be limited to lines less than 36-inch average inside diameter.
  2. Lines 36-inch average inside diameter and larger shall be tested at each joint. Minimum time allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch during joint test shall be 10 seconds, regardless of pipe size.
  3. For pipe sections less than 36-inch average inside diameter:
    - a. Determine ground water level.
    - b. Plug both ends of pipe. For concrete pipe, flood pipe and allow 2 hours to saturate concrete. Then drain and plug concrete pipe.
    - c. After manhole-to-manhole section of sanitary sewer main has been sliplined and prior to any service lines being connected to new liner, plug liner at each manhole with pneumatic plugs.
    - d. Pressurize pipe to 4.0 psig. Increase pressure 1.0 psi for each 2.3 feet of ground water over highest point in system. Allow pressure to stabilize for 2 to 4 minutes. Adjust pressure to start at 3.5 psig (plus adjustment for ground water table). See Table 15250-2 at end of this Section.
    - e. To determine air loss, measure time interval for pressure to drop to 2.5 psig. Time must exceed that listed in Table 15250-2 at end of this Section for pipe diameter and length. For sliplining, use diameter of carrier pipe.
- F. Retest: Repair and retest any section of pipe which fails to meet requirements.

## .05 TEST CRITERIA TABLES

- A. Exfiltration and Infiltration Water Tests: Refer to Table 15250-1, Water Test Allowable Leakage, at end of this Section.
- B. Low Pressure Air Test:
1. Times in Table 15250-2, Time Allowed For Pressure Loss From 3.5 psig

to 2.5 psig, at end of this Section, are based on equation from Texas Commission on Environmental Quality (TCEQ) Design Criteria 317.2(a)(4)(B). If the state where the project is being completed has more stringent times, the local state's requirements will apply.

		$T = 0.0850(D)(K)/(Q)$
where:	T =	Time for pressure to drop 1.0 pounds per square inch gauge in seconds
	K =	0.000419 DL, but not less than 1.0
	D =	Average inside diameter in inches
	L =	Length of line of same pipe size in feet
	Q =	Rate of loss, 0.0015 ft <sup>3</sup> /min./sq.ft. internal surface

- Since K value of less than 1.0 shall not be used, there are minimum testing times for each pipe diameter as given in Table 15250-3, Minimum Testing Times for Low Pressure Air Test.

Notes:

- When two sizes of pipe are involved, compute time by ratio of lengths involved.
- Lines with 27-inch average inside diameter and larger may be air tested at each joint.
- Lines with average inside diameter greater than 36 inches must be air tested for leakage at each joint.
- If joint test is used, perform visual inspection of joint immediately after testing.
- For joint test, pipe is to be pressurized to 3.5 psi greater than pressure exerted by groundwater above pipe. Once pressure has stabilized, minimum times allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be 10 seconds.

## .06 LEAKAGE TESTING FOR MANHOLES

- After completion of manhole construction, wall sealing, or rehabilitation, but prior to backfilling, test manholes for water tightness using hydrostatic or vacuum testing procedures.
- Plug influent and effluent lines, including service lines, with suitably-sized pneumatic or mechanical plugs. Ensure plugs are properly rated for pressures required for test; follow manufacturer's safety and installation recommendations. Place plugs minimum of 6 inches outside of manhole walls. Brace inverts to prevent lines from being dislodged when lines entering manhole have not been backfilled.

C. Vacuum testing:

1. Install vacuum tester head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer's instructions and safety precautions, inflate sealing element to recommended maximum inflation pressure; do not over-inflate.
2. Evacuate manhole with vacuum pump to 10 inches mercury (Hg), disconnect pump, and monitor vacuum for time period specified in Table 15250-4, Vacuum Test Time Table.
3. If drop in vacuum exceeds 1 inch Hg over specified time period tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

D. Perform hydrostatic exfiltration testing as follows:

1. Seal wastewater lines coming into manhole with internal pipe plug. Then fill manhole with water and maintain it full for at least one hour.
2. The maximum leakage for hydrostatic testing shall be 0.025 gallons per foot diameter per foot of manhole depth per hour.
3. If water loss exceeds amount tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

## .07 SMOKE TEST PROCEDURE FOR POINT REPAIRS

A. Application: Perform smoke test to:

1. Locate points of line failure for point repair.
2. Determine when point repairs are properly made.
3. Determine when service connections have been reconnected to rehabilitated sewer.
4. Check integrity of connections to newly replaced service taps to liners and to existing private service connections.

B. Limitations: Do not backfill service taps until completion of this test. Test only those taps in single manhole section at one time. Keep number of open excavations to minimum.

C. Preparation: Prior to smoke testing, give written notices to area residents no fewer than 2 days, nor more than 7 days, prior to proposed testing. Also give notice to local police and fire departments 24 hours prior to actual smoke testing.

- D. Isolate Section: Isolate manhole section to be tested from adjacent manhole sections to keep smoke localized. Temporarily seal annular space at manhole for sliplined sections.
- E. Smoke Introduction:
  - 1. Operate equipment according to manufacturer's recommendation and as approved by Project Manager.
  - 2. Conduct test by forcing smoke from smoke generators through sanitary sewer main and service connections. Operate smoke generators for minimum of 5 minutes.
  - 3. Introduce smoke into upstream and downstream manhole as appropriate. Monitor tap/connection for smoke leaks. Note sources of leaks.
- F. Repair and Retest: Repair and replace taps or connections noted as leaking and then retest. Taps and connections may be left exposed in only one manhole section at time. When repair or replacement, testing or retesting, and backfilling of excavation is not completed within one work day, properly barricade and cover each excavation as approved by Project Manager.
- G. Service Connections: On houses where smoke does not issue from plumbing vent stacks to confirm reconnection of sewer service to newly installed liner pipe, perform dye test to confirm reconnection. Introduce dye into service line through plumbing fixture inside structure or sewer cleanout immediately outside structure and flush with water. Observe flow at service reconnection or downstream manhole. Detection of dye confirms reconnection.

## .08 TELEVISION INSPECTION PROCEDURES

### A. SEWER FLOW REQUIREMENTS

- 1. Do not exceed depth of flow shown in Table 1 for respective pipe sizes as measured in manhole when performing TV inspection.
- 2. When depth of flow at upstream manhole of sewer line section being worked is above maximum allowable for TV inspection, reduce flow to level shown in Table 1, by plugging or blocking of flow, or by pumping and bypassing of flow as specified.



**TABLE 1**  
**Maximum Depth of Flow for TV Inspection**

Nominal Pipe Diameter	Maximum Depth of Flow
6" - 10"	20 percent of pipe diameter
12" - 24"	25 percent of pipe diameter

## B. SEQUENCE OF WORK

Perform Work in the following sequence:

1. Clean sewer lines and manholes in accordance with requirements of specifications".
2. Perform TV inspection to comply with requirements of this specification.

## C. INSPECTION REQUIREMENTS

1. Access: AWE shall have access to observe monitor and other operations at all times.
2. DVD Commentary: Record the following information on audio track of DVD inspection tape: narrative of location, direction of view, manhole numbers, pipe diameter and material, date, time of inspection, and location of laterals and other key features
  - a. DVD shall visually display this information at beginning and end of each manhole-to-manhole pipe segment.
  - b. DVD between manholes shall visually display length in feet from starting point of given segment.
3. Sewer Identification: DVD and inspection documentation shall include sewer line and manhole identifiers shown on Drawings. After installation of liner, use upstream manhole as identifier in conjunction with distance meter.
4. Image Perspective: Camera image shall be down center axis of pipe when camera is in motion.
  - a. Provide 360-degree sweep of pipe interior at points of interest, to more fully document existing condition of sewer.
  - b. Points of interest may include, but are not limited to the following: defects, encrustations, mineral deposits, debris, sediment, and any location determined not to be clean or part of proper liner



installation, and defects in liner that include, but are not limited to bumps, folds, tears, and dimples.

- c. Cabling system employed to transport camera and transmit its signal shall not obstruct camera's view.
5. Sewer Reach Length: Physically measure and record length of each sewer reach from centerline of its terminal manholes.
6. Inspection Rate: Camera shall be pulled through sewer in either direction, but both inspections are to be in same direction. Maximum rate of travel shall be 30 feet (9 m) per minute when recording.

#### D. FIELD QUALITY CONTROL

1. AWE will review DVD's and logs to ensure lines are clean and free of visible defects.
2. If sewer line, in sole opinion of AWE, is not adequately clean, and free of visual defects it shall be recleaned and CCTV-inspected by Contractor at no additional cost.

**TABLE 15250-1**  
**WATER TEST ALLOWABLE LEAKAGE**

DIAMETER OF RISER OR STACK IN INCHES	VOLUME PER INCH OF DEPTH		ALLOWANCE LEAKAGE*	
	INCH	GALLONS	PIPE SIZE IN INCHES	GALLONS/MINUT E PER 100FT.
1	0.7854	.0034	6	0.0039
2	3.1416	.0136	8	0.0053
2.5	4.9087	.0212	13	0.0066
3	7.0686	.0306	12	0.0079
4	12.5664	.0306	15	0.0099
5	19.6350	.0544	18	0.0118
6	28.2743	.1224	21	0.0138
8	50.2655	.2176	24	0.0158
			27	0.0177
			30	0.0197
			36	0.0237
			42	0.0276
For other diameters, multiply square of daiameters by value of 1" diameter			Equivalent to 50 gallons per inch of inside diameter per mile per 24 hours	

\* Allowable leakage rate shall be reduced to 10 gallons per inch of inside diameter per mile per 24 hours, when sewer is identified as located within 25-year flood plain



**TABLE 15250-2**  
**ACCEPTANCE TESTING FOR SANITARY SEWERS**

TIME ALLOWED FOR PRESSURE LOSS FROM 3.5 PSIG TO 2.5 PSIG

Pipe Diam. (in)	Min. Time (min/s ec)	Length for min. time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) shown (min:sec)											
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	500 ft	550 ft	600 ft	
6	5:40	398	0.854	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:25	7:07	7:50	8:33	
8	7:33	298	1.519	7:33	7:33	7:33	7:33	7:36	8:52	10:08	11:24	12:40	13:56	15:12	
10	9:27	239	2.374	9:27	9:27	9:27	9:54	11:52	13:51	15:50	17:48	19:47	21:46	23:45	
12	11:20	199	3.419	11:20	11:20	11:20	14:15	17:06	19:57	22:48	25:39	28:30	31:20	34:11	
15	14:10	159	5.342	14:10	14:10	17:48	22:16	26:43	31:10	35:37	40:04	44:31	48:58	53:25	
18	17:00	133	7.692	17:00	19:14	25:39	32:03	38:28	44:52	51:17	57:42	64:06	70:31	76:56	
21	19:50	114	10.47	19:50	26:11	34:54	43:38	52:21	61:05	69:48	78:32	87:15	95:59	104:42	
24	22:40	99	13.67	22:48	34:11	45:35	56:59	68:23	79:47	91:10	102:34	113:58	125:22	136:46	
27	25:30	88	17.30	28:51	43:16	57:42	72:07	86:33	100:58	115:24	129:49	144:14	158:40	173:05	
30	28:20	80	21.36	35:37	53:25	71:14	89:02	106:51	124:39	142:28	160:16	178:05	195:53	213:41	
33	31:10	72	25.85	43:06	64:38	86:11	107:44	129:17	150:50	172:23	193:55	215:28	237:01	258:34	

**TABLE 15250-3**

MINIMUM TESTING TIMES FOR SANITARY SEWERS - LOW PRESSURE AIR TEST

PIPE DIAMETER (inches)	MINIMUM TIME (seconds)	LENGTH FOR MINIMUM TIME (feet)	TIME FOR LONGER LENGTH (seconds)
6	340	398	0.855 (L)
8	454	298	1.520 (L)
10	567	239	2.374 (L)
12	680	199	3.419 (L)
15	850	159	5.342 (L)
18	1020	133	7.693 (L)
21	1190	114	10.471 (L)
24	1360	100	13.676 (L)
27	1530	88	17.309 (L)
30	1700	80	21.369 (L)
33	1870	72	25.856 (L)

**TABLE 15250-4**  
 MINIMUM TESTING TIMES FOR SANITARY MANHOLES - LOW PRESSURE AIR  
 TEST

DEPTH IN FEET	TIME IN SECONDS BY PIPE DIAMETER		
	48"	60"	72"
4	10	13	16
8	20	26	32
12	30	39	48
16	40	52	64
20	50	65	80
24	60	78	96
*	5.0	6.5	8.0
*Add T times for each additional 2-foot depth. (The values listed above have been extrapolated from ASTM C 924-85)			



**TABLE 15250-5**  
**PIPE VS. MANDREL DIAMETER**

Material and Wall Construction	Nominal Size (Inches)	Average I.D (Inches)	Minimum Mandrel Diameter (Inches)
PVC-Solid (SDR 26)6	6	5.764	5.476
	8	7.715	7.329
	10	9.646	9.162
PVC-Solid (SDR 35)12	12	11.737	11.150
	15	14.374	13.655
	18	17.629	16.748
	21	20.783	19.744
	24	23.381	22.120
	27	26.351	25.033
PVC-Truss	8	7.750	7.363
	10	9.750	9.263
	12	11.790	11.201
	15	14.770	14.032
PVC-Profile (ASTM F 794)	12	11.740	11.153
	15	14.370	13.652
	18	17.650	16.768
	21	20.750	19.713
	24	23.500	22.325
	27	26.500	25.175
	30	29.500	28.025
	36	35.500	33.725
	42	41.500	39.425
	48	47.500	45.125
HDPE-Profile	18	18.000	17.100
	21	21.000	19.950
	24	24.000	22.800
	27	27.000	25.650
	30	30.000	28.500
	36	36.000	34.200
	42	42.000	39.900
	48	48.000	45.600
	54	54.000	51.300
	60	60.000	57.000
Fiberglass (Class SN 46)	12	12.85	11.822
	18	18.66	17.727
	20	20.68	19.646
	24	24.72	23.484
	30	30.68	29.146
	36	36.74	34.903
	42	42.70	40.565
	48	48.76	46.322
	54	54.82	52.079
	60	60.38	57.361

**END OF SECTION 15250**

## SECTION 15260

### SANITARY SEWER SERVICE STUBS OR RECONNECTIONS

#### PART 1 GENERAL

##### .01 SECTION INCLUDES

- A. Installation of service stubs in sanitary sewers serving areas where sanitary sewer service did not previously exist.
- B. Reconnection of existing service connections along parallel, replacement, or rehabilitated sanitary sewers.

##### .02 PERFORMANCE REQUIREMENTS

- A. Accurately locate in field all proposed service stubs along new sanitary sewer main.
- B. Accurately locate in field existing service connections and proposed service stubs along alignment of new parallel or replacement sewer main.

##### .03 SUBMITTALS

- A. Conform to requirements of Section 01300 - Submittals.
- B. Submit product data for each pipe product, fitting, coupling and adapter.
- C. Show reconnected services on record drawings. Give exact distance from each service connection to nearest downstream manhole.

#### PART 2 PRODUCTS

##### .01 PVC SERVICE CONNECTION

- A. As stub outs, use PVC sewer pipe of 4-inch through 10-inch diameter, conforming to ASTM D 1784 and ASTM D 3034, with cell classification of 12454-B. SDR (ratio of diameter to wall thickness) shall be 26 for pipe 10 inches in diameter or less.
- B. PVC pipe shall be gasket jointed with gasket conforming to ASTM D 3212.
- C. Provide service connection pipe in sizes shown on Drawings. For reconnection of existing services, select service connection pipe diameter to match existing service diameter. Reconnections to rehabilitated sanitary sewer mains shall be limited to following maximum service connection diameter:

Sewer Diameter	Maximum Service Connection Diameter
8" or less	4"
10" or less	6"

- D. Subject to above limits, provide 6-inch service connection when more than one service discharges into single pipe.
- E. Connect service pipes to parallel or replacement sewer mains with prefabricated, full-bodied tee or wye fittings conforming to specifications for sewer main pipe material as specified in other Sections for sewers up to 18 inches in diameter.
- F. Where sewers are installed using pipe augering or tunneling, or where sewer is greater than 18 inches in diameter, use Fowler "Inserta-Tee" to connect service to sewer main.

## .02 PIPE SADDLES

- A. Use pipe saddles only on rehabilitated sanitary sewer mains. Comply with Paragraph 2.01E for new parallel and replacement sanitary sewer mains.
- B. Supply one-piece prefabricated saddle, either polyethylene or PVC, with neoprene gasket to accomplish complete seal. Use saddle fabricated to fit outside diameter of connecting pipe. Protruding lip of saddle must be at least 5/8-inch long with grooves or ridges to retain stainless steel band clamps.
- C. Use 1/2-inch stainless steel band clamps for securing saddles to liner pipe.

## .03 COUPLINGS AND ADAPTERS

- A. For connections between new PVC pipe stubouts and existing service, 4-, 6-, or 8-inch diameter, use flexible adapter coupling consisting of neoprene gasket and stainless steel shear rings with 1/2-inch stainless steel band clamps:
  1. Fernco Pipe Connectors, Inc. Series 1055 with shear ring SR-8
  2. Band Seal by Mission Rubber Co., Inc.
  3. Approved equal.
- B. For connections between new PVC pipe stubout and new service, use rubber-gasket adapter coupling:
  1. GPK Products, Inc.
  2. IPS & Sewer Adapter

### 3. Approved equal.

#### .04 STACKS

- A. Provide stacks for service connections wherever crown of sewer is 8 feet or more below finished grade.
- B. Construct stacks of same material as sanitary sewer and as shown on Drawings.
- C. Provide stacks of same nominal diameter at sanitary service line.

#### .05 PLUGS AND CAPS

- A. Seal upstream end of unconnected sewer service stubs with rubber gasket plugs or caps of same pipe type and size. Provide plugs or caps by GPK Products, Inc., or approved equal.

## PART 3 EXECUTION

#### .01 PERFORMANCE REQUIREMENTS

- A. Provide minimum of 72 hours notice to customers whose sanitary sewer service will potentially be interrupted.
- B. Accurately field locate service connections, whether in service or not, along rehabilitated sanitary sewer main. For parallel and replacement sewers, service connections may be located as pipe laying progresses from downstream to upstream.
- C. Properly disconnect existing connections from sewer and reconnect to rehabilitated liner, as described in this Section.
- D. Reconnect service connections, including those that go to unoccupied or abandoned buildings or to vacant lots, unless directed otherwise by Project Manager.
- E. Complete reconnection of service lines within 24 hours after cured-in-place liner installation and within 72 hours after disconnection for sliplining, parallel, or replacement sanitary sewer mains.
- F. Reconnect services on cured-in-place liner at 12 feet depth or less by excavation method. Project Manager reserves right to require service connections by excavation when remote cut service connection damages lines.
- G. Reconnection by excavation method shall include stack and fittings and required pipe length to reconnect service line.

- H. Connect services 8 inches in diameter and larger to sewer by construction of manhole. Refer to appropriate Section on manholes for construction and payment.

## .02 PROTECTION

- A. Provide barricades, warning lights, and signs for excavations created for service connections.
- B. Do not allow sand, debris, or runoff to enter sewer system.

## .03 PREPARATION

- A. Determine existing sewer locations and number of existing service connections from closedcircuit television (CCTV) inspection tapes or from field survey. Accurately field locate existing service connections, whether in service or not. Use existing service locations to connect or reconnect service lines or liner.
- B. For rehabilitated sanitary sewer mains, allow liner to normalize to ambient temperature and recover from imposed stretch. For cured-in-place liners, verify that liner is completely cured.
- C. For new parallel and replacement sanitary sewer mains, complete testing and acceptance of downstream sewers as applicable. Provide for compliance with requirements of Paragraph 3.01E.

## .04 EXCAVATION AND BACKFILL

- A. Excavate in accordance with Section 02317 - Excavation and Backfill for Utilities.
- B. Perform work in accordance with OSHA standards.
- C. Install and operate necessary ground water and surface water control measures in accordance with requirements of the contract documents.
- D. Determine locations where limited access, buildings or structure preclude use of mechanical excavation equipment. Obtain approval from Project Manager for hand excavation.

## .05 RECONNECTION BY EXCAVATION METHOD

- A. Remove portion of existing sanitary sewer main or carrier pipe to expose liner pipe. Provide sufficient working space for installing prefabricated pipe saddle.
- B. Carefully cut liner pipe making hole to accept stubout protruding from underside of saddle.



- C. Strap on saddle using stainless steel band on each side of saddle. Tighten bands to produce watertight seal of saddle gasket to liner pipe.
- D. Remove and replace cracked, offset, or leaking service line for up to 5 feet, measured horizontally, from center of new liner.
- E. Make up connection between liner and service line using PVC sewer pipe and approved fittings and couplings.
- F. Encase entire service connection in cement stabilized sand as shown on Drawings.
- G. Test service connections before backfilling.

#### .06 RECONNECTION BY REMOTE METHOD

- A. Make service reconnections using remote-operated cutting tools on cured-in-place liners at depth greater than 12 feet.
- B. Employ method and equipment that restore service connection capacity to not less than 90 percent of original capacity.
- C. Immediately open missed connections and repair holes drilled in error using method approved by Project Manager.

#### .07 RECONNECTION ON PARALLEL OR REPLACEMENT SEGMENTS

- A. Install service connections on sewer main.
- B. Remove and replace cracked, offset or leaking service line for up to 5 feet, measured horizontally, from centerline of sanitary sewer main.
- C. Make up connection between main and existing service line using PVC sewer pipe and approved couplings, as shown on Drawings.
- D. Test service connections before backfilling.
- E. Embed service connection and service line as specified for sanitary sewer main as shown on Drawings. Place and compact trench zone backfill in compliance with Section 02317 - Excavation and Backfill for Utilities.

#### .08 INSTALLATION OF NEW SERVICE STUBS

- A. Install service connections on sanitary sewer main for each service connection. Provide length of stub indicated on Drawings. Install plug or cap on upstream end of service stub as needed.
- B. Test service connections before backfilling.
- C. Embed service connection and service line as specified for sanitary sewer main, and as shown on Drawings. Place and compact trench zone backfill in compliance with Section 02317 - Excavation and Backfill for Utilities.

Install minimum 2-foot length of magnetic locating tape along axis of service stub and 9 inches to 12 inches above crown of pipe, at end of stub.

#### .09 TESTING

- A. Test service reconnections and service stubs. Follow applicable procedures given in Section 15250 - Acceptance Testing for Sanitary Sewers to perform smoke testing to confirm reconnection.
- B. Perform post installation CCTV inspection as specified in the contract documents. Cleaning and Television Inspection to show locations of service connection.

#### .010 CLEANUP

- A. Backfill excavation as specified in Section 02317 - Excavation and Backfill for Utilities.
- B. Replace pavement or sidewalks removed or damaged by excavation in accordance with Section 02614- Curbs, Driveways, and Sidewalks. In unpaved areas, bring surface to grade and slope surrounding excavation. Restore disturbed lawn areas in accordance with Section 02820 – Lawn Restoration.

### **END OF SECTION 15260**



## SECTION 15290

### PUMPING AND BYPASSING

#### PART 1 GENERAL

##### .01 SECTION INCLUDES

- A. Under this item, the Contractor is required to furnish all materials, labor, equipment, power, maintenance, etc. to implement a temporary pumping system for the purpose of diverting the existing flow around the work area for the duration of the project.
- B. The design, installation, and operation of the temporary bypass pumping system shall be the Contractor's responsibility. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

##### .02 SUBMITTALS

- A. Conform to requirements of Section 01300 – Submittal Procedures
- B. The following additional items shall be submitted for approval in accordance with Section 01300:
  - a. Detailed Bypass Pumping Plan – The Contractor shall submit to American Water detailed plans and descriptions outlining all provisions and precautions to be taken by the Contractor regarding the handling of existing wastewater flows. The plan must be specific and complete, including such items as schedules, locations, elevations, capacities of equipment, materials and all other incidental items necessary and/or required to insure proper protection of AW facilities. No construction shall commence until the work plan has been reviewed and approved by AW. The Bypass Pumping Plan may require the following specifics:
    - i. Staging area for pumps.
    - ii. Sewer plugging method and types of plugs.
    - iii. Number, size, material, location, and method of installation of suction pipe.
    - iv. Number, size, material, location, and method of installation of discharge pipe.
    - v. Bypass pump sizes, capacity, and power requirements.
    - vi. Calculation of static lift, friction losses, and flow velocity (submit pump curves with operating point noted).



- vii. Standby power generator and size and location.
- viii. Downstream discharge plan.
- ix. Method of protecting discharge manhole.
- x. Thrust and restraint block sizes and locations.
- xi. Sections showing suction and discharge pipe depth, embedment, select fill, and special backfill.
- xii. Method of noise control for pumps and generators.
- xiii. Temporary pipe supports and anchoring required.
- xiv. Design plan and computation for access to bypass pumping locations indicated on drawings.
- xv. Calculations for selection of bypass pumping pipe size.
- xvi. Schedule for installation of and maintenance of bypass pumping lines.
- xvii. Plan indicating selection location of bypass pumping line locations.

## **PART 2 PRODUCTS –**

### **.01 EQUIPMENT**

- A. All pumps used shall be fully automatic self-priming units that do not require the use of foot-valves or vacuum pumps in the priming system. The pumps may be electric or diesel powered. All pumps used must be constructed to allow dry running for long periods of time to account for the cyclical nature of effluent flows.
- B. The Contractor shall provide the necessary stop/start controls for each pump.
- C. The Contractor shall include one stand-by pump for each size to be maintained on site. Back-up pumps shall be on-line, isolated from the primary system by a valve.
- D. Discharge Piping – In order to prevent the accidental spillage of flows, all discharge systems shall be temporarily constructed of rigid pipe with positive, restrained joints. Under no circumstance will aluminium irrigation type piping or glued PVC pipe be allowed. Discharge hose will only be allowed in short sections and by specific permission from American Water.



## .02 DESIGN REQUIREMENTS

- A. Bypass pumping systems shall have sufficient capacity to pump the peak flow required. The Contractor shall provide all pipeline plugs, pumps of adequate size to handle peak flow, and temporary discharge piping to ensure that the total flow of the main can be safely diverted around the section to be repaired. Bypass pumping system will be required to be operated 24 hours a day.
- B. The Contractor shall have adequate standby equipment available and ready for immediate operation and use in the event of an emergency or breakdown. One standby pump for each pump size utilized shall be installed at the mainline flow bypassing locations, ready for use in the event of primary pump failure.
- C. Bypass pumping system shall be capable of bypassing flow around the work area and of releasing any amount of flow up to the full available flow into the work area as necessary for satisfactory performance of the work.
- D. The Contractor shall make all arrangements for bypass pumping during the time when the main is shut down for any reason. System must overcome any existing force main pressure on discharge.

## .03 PERFORMANCE REQUIREMENTS

- A. It is essential to the operation of the existing sewerage system that there be no interruption in the flow of sewage throughout the duration of the project. To this end, the Contractor shall provide, maintain, and operate all temporary facilities such as dams, plugs, pumping equipment (both primary and back-up units as required), conduits, all necessary power, and all other labor and equipment necessary to intercept the sewage flow before it reaches the point where it would interfere with work, carry it past his work, and return it to the existing sewer downstream of work.
- B. The design, installation, and operation of the temporary pumping system shall be the Contractor's responsibility. The bypass system shall meet the requirements of all local, state, and federal codes and regulations.
- C. Contractor shall provide all necessary means to safely convey the sewage past the work area. The Contractor will not be permitted to stop or impede the main flows under any circumstances.
- D. The Contractor shall maintain sewer flow around the work area in a manner that will not cause surcharging of sewers, damage to sewers, and that will protect public and private property from damage and



flooding.

- E. The Contractor shall protect water resources, wetlands, and other natural resources.

## **PART 3 EXECUTION**

### **.01 FIELD QUALITY CONTROL AND MAINTENANCE**

- A. Test - The Contractor shall perform leakage and pressure tests of the bypass pumping discharge piping using clean water prior to actual operation. The Engineer will be given 24 hours notice prior to testing.
- B. Inspection - Contractor shall inspect bypass pumping system every two hours to ensure that the system is working properly.
- C. Maintenance Service - Contractor shall insure that the temporary pumping system is properly maintained and a responsible operator shall be on hand at all times when pumps are operating.
- D. Extra Materials:
  - a. Spare parts for pumps and piping shall be kept on site as required.
  - b. Adequate hoisting equipment for each pump and accessories shall be maintained on the site.

### **.02 PREPARATION**

- A. Precautions
  - a. Contractor is responsible for locating any existing utilities in the area the Contractor selects to locate the bypass pipelines. The Contractor shall locate his bypass pipelines to minimize any disturbance to existing utilities and shall obtain approval of the pipeline locations from American Water. All costs associated with relocating utilities and obtaining approvals shall be the responsibility of the Contractor.
  - b. During all bypass pumping operation, the Contractor shall protect the pumping station and main and all local sewer lines from damage inflicted by any equipment. The Contractor shall be responsible for any physical damage to the pump station and main and all local sewer lines caused by human or mechanical failure.

### **.03 INSTALLATION AND REMOVAL**

- A. The Contractor shall remove manhole sections or make connections to the existing sewer and construct temporary bypass pumping structures only at the access location indicated on the Drawings and as may be required to provide suction conduit.



- B. Plugging or blocking of sewage flows shall incorporate primary and secondary plugging device. When plugging or blocking is no longer needed for performance and acceptance of work, it is to be removed in a manner that permits the sewage flow to slowly return to normal without surge, to prevent surcharging, or causing other major disturbances downstream.
- C. When working inside a manhole or force main, the Contractor shall exercise caution and comply with OSHA requirements when working in the presence of sewer gases, combustible oxygen-deficient atmospheres, and confined spaces.
- D. The installation of the bypass pipelines is prohibited in all saltmarsh/wetland areas. The pipeline must be located off streets sidewalks, and on shoulders of the roads. When the bypass pipeline crosses local streets and private driveways, the contractors must place the bypass line in trenches and cover with temporary pavement. Upon completion of the bypass pumping operations, and after the receipt of written permission from the Engineer, the Contractor shall remove all the piping, restore all property to pre-construction condition, and restore all pavement. The Contractor is responsible for obtaining any approvals for placement of temporary pipelines from local agencies.

**END OF SECTION 15290**



## SECTION 15400

### WATER STORAGE TANK REMOVAL

#### PART 1 GENERAL

##### .01 SECTION INCLUDES

- A. Removal of existing water storage tanks, including disconnecting and capping of all piping, demolition of foundations, and grading and seeding of all disturbed areas.

##### .02 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for demolition of existing structures.
- B. Conform to applicable codes for disposal of debris.

##### .03 SUBMITTALS

- A. Conform to requirements of Section 01300 – Submittals.
- B. The following additional items shall be submitted for approval in accordance with Section 01300:
  - a. Detailed Work Plan – This plan shall be submitted within 15 days after the issuance of the Notice to Proceed and shall detail all proposed methods and sequences of operations including, but not limited to:
    - i. Tank apputenance removal.
    - ii. Removal and disposal of industrial waste.
    - iii. Dismantling procedures.
    - iv. Transportation and disposal of aboveground water tanks and contents.
    - v. Protection of existing structures and utilities.
    - vi. Site safety plan.
  - b. Documentation of acceptance of waste materials by a permitted facility capable to dispose of said waste materials. Documentaion must be provided within 7 days of delivery to permitted facility.
  - c. Letters of acceptance from permitted facilities and haulers. Letters shall be provided at least 14 days prior to transportation of any wastes.





#### .04 SPECIAL CONDITIONS

- A. Lead Paint Cleanup
  - a. The Contractor shall take all necessary precautions to prevent any environmental contamination of the surrounding area due to the presence of lead paint on the storage tanks to be removed.
  - b. The Contractor shall follow all federal, state, and local regulations governing the clean up and disposal of lead paint contamination.

### PART 2 PRODUCTS - NOT USED

### PART 3 EXECUTION

#### .01 REMOVAL OF WATER TANKS

- A. The procedures to remove the existing water tanks shall include, but not be limited to, the following:
  - a. Remove all electrical conduit and apputrances from the tanks prior to dismantling of the tanks.
  - b. Remove all water that may be present that is capable of being pumped out of the tanks.
  - c. Drain or flush all water from piping into the tanks.
  - d. Disconnect and cap all piping.
  - e. Remove aboveground water tanks in accordance with approved work plan.
- B. The foundations of the aboveground water tanks shall be removed down to a depth of 2' below grade. Contractor shall be responsbile for backfill of foundations abandoned in place.

#### .02 DISPOSAL OF TANK CONTENTS AND DEMOLISHED MATERIALS

- A. All removed tank materials shall be loaded and trucked away from the site in such a manner as to not cause any hazard for passersby or damage to any existing facility. Any damage shall be repaired or replaced by the Contractor at no additional cost to AW.
- B. All waste material shall be disposed of in accordance with all federal, state, and local regulations.
- C. All waste materials shall become the responsibility of the Contractor and the Contractor shall be repsonsible for the safe and proper removal and disposal of all waste materials.
- D. Storage of waste materials at the site is not permitted.



- E. All fees and transportation costs are the responsibility of the Contractor. The Contractor shall bear full responsibility for any and all fines against the project resulting from the improper handling and disposal of the waste materials.

.03 BACKFILL

- A. Backfill of removal areas shall be in accordance with requirements of Section 02317- Excavation and Backfill for Utilities.

.04 RESTORATION

- A. Restoration of all disturbed areas shall be in accordance with requirements set forth in Section 02820 – Lawn Restoration

**END OF SECTION 15400**

## SECTION 15410

### GROUND WATER STORAGE TANKS

#### PART 1 GENERAL

##### .01 SCOPE

- A. Section Includes Requirements for designing, fabricating, and erecting a welded steel ground storage tank.

##### .02 SYSTEM DESCRIPTION

###### A. Design Requirements

1. Design steel tank for capacity and dimensions as set forth in the request for proposals.
2. Layout of floor plates to be such that seams parallel to edges or intersecting with corners of concrete foundation or pipe encasement have 1-foot minimum spacing distance from these edges or corners.
3. Shell and floor plate thickness is  $\frac{1}{4}$  inch minimum or required thickness determined by design plus  $\frac{1}{16}$  inch corrosion allowance whichever is greater.

###### B. Design Requirements:

1. Tank design is to comply with AWWA Specifications and dimensions specified above.
2. Perform welding in accordance with latest editions of applicable specifications of the American Welding Society.
3. Tank walls to be of butt welded construction. Roof to be a stiffened self supporting dome or umbrella type.
4. Tank constructed so as to receive a stroke of lightning without damage as outlined by NFPA 780, Chapter 3 and 4. Tank manufacturer to submit sufficient evidence, in form of calculations or other justification of how this requirement will be met.

- a. If tank manufacturer cannot meet these requirements, as determined by Engineer; provide a lightning protection system for tank which includes air terminals and down leads.
- b. If tank manufacturer can meet these requirements, provide a lightning protection system, excluding air terminals and down leads, as indicated on drawings for the tank.
- c. In either case, perform installation by a Master Labeler Shop or company.

### .03 SUBMITTALS

- A. Shop Drawings: Submit shop drawings where indicated
- B. Tank and Foundation Drawings: Submit detail drawings for steel tank and accessories and any foundation modifications to Engineer for approval before fabrication or erection is begun. Indicate on tank drawing whether design is based on AWWA D100 or on AWWA D100, Section 14-Alternate Design Basis for Standpipe and Reservoir. . Included with this submittal shall be details of all weld joints referenced in the above drawings, showing the plate edge preparation, the type of electrode, the number of weld passes and other information pertinent to each weld joint.
- C. Design Computations: Submit design computations for steel tank, accessories and foundation to Engineer for review before tank fabrication is begun. Design computations as submitted are to be certified by a Licensed Professional Engineer in the state which the Project is located. Engineer's review comments does not in any way relieve responsibility for accuracy and completeness of design.
- D. Radiograph/Welding Reports: Submit report of radiograph inspections and a welding report if design incorporated AWWA D100 – Section 14.
- E. Provide certification that the steel plates and structural members are manufactured in the United States and are free from inclusions of slag and other foreign matter and also free from heavy deposits of rust and/or pitting.
- F. Upon completion of erection of the tank, provide Owner with a “Notarized Certification of Compliance” stating that the tank has been designed, fabricated, erected, inspected and tested in accordance with all of the requirements of AWWA Standard D-100 and that the results of all inspection, radiographs and tests indicate that the tank is in full compliance with said AWWA Standard D100.



## PART 2 PRODUCTS

### .01 MATERIAL

#### A. Tank Disinfection and Painting Systems

1. Provide tank disinfection in accordance with AWWA standards.
2. Provide tank painting conforming to Section 15420, Water Storage Tank Painting.

### .02 ACCESSORIES

#### A. Roof Hatches (Two Required):

1. Provide two hatches of minimum 24 inches square with a 4-inch neck and located near roof perimeter. Provide cover with hinges and a hasp on outside.
2. Provide two hatches of minimum 24 inches in diameter with a 4-inch flanged neck with gasketed, and bolted cover. Locate near center of roof with Engineer's approval, and if the requirements of this hatch and roof vent can be incorporated into one opening, roof hatch and vent can be combined.

#### B. Shell Manholes (three required): minimum 30-inch diameter, gasketed, bolted, and hinged on outside.

#### C. Bolting, Hasp and Hinge Material: Stainless steel bolting, ASTM A320 (Type 304), for all manholes, hatches and overflow piping. Hasps and hinges to be type 304 stainless steel. Provide gaskets of red rubber material.

#### D. Overflow: 6 inch (min) diameter steel ( $\frac{1}{2}$ inch wall in wet areas, $\frac{1}{4}$ inch wall in dry areas) or ductile iron overflow pipe and weir box to have a 12500 gpm minimum capacity with water level not more than 12 inches above the overflow elevation. Minimum depth of weir box is 4.0 feet. Coat steel pipe inside and out as the tank. Coat ductile iron pipe exterior the same as the tank.

#### E. Vertical Outside Ladder with Safe-T-Climb Rail: Start 15 feet minimum above proposed grade. Provide aluminum vandal deterrent at base of ladder. Provide ladder no less than 16 inches wide with minimum 2 inch x $\frac{5}{16}$ inch side rails, 7 inch minimum toe room and $\frac{3}{4}$ inch diameter minimum non-slip rungs. Safe-T-Climb system is as manufactured by North Safety Products or equal. Rail members are to be galvanized material. Provide two Safe-T-Lock sleeves and harnesses.

- F. Roof Platform: Construct with steps and handrails on both sides to the point where the roof slope is 2 in 12 or less. From this point, provide stainless steel safety cable with support posts to the apex of the roof so as personnel can remain tied-off while accessing the manhole and vent. Construction of platform to allow stepped portion to be removed such that the roof plate and platform underside is accessible for painting. Provide 4 x ¼ inch toe plate on all railing. Construction to meet AWWA, OSHA, federal, state and local requirements.
- G. Roof Vent: A minimum of two roof vents shall be provided and protected with insect screens.
- H. Grounding lugs. Provide four (4) equally spaced grounding lugs welded to base of shell.
- I. Tank Anchors and Anchor Chair: If required, quantity and location to be designed by the tank manufacturer.
- J. Steel Inlet/Outlet Piping: Provide steel (1/2-inch wall) or ductile iron inlet and outlet flanged piping as shown on the Drawings. Coat steel pipe inside and out as the tank.  
  
Coat ductile iron pipe exterior in the same fashion as the tank.
- K. Tank Drain: Provide separate tank drain pipe to a drain hydrant as shown on the Drawings.

### .03 SOURCE QUALITY CONTROL

- A. The Owner reserves the right to perform shop inspection of materials and shop fabrication and painting procedures. Submit an accurate shop fabricating and painting schedule for all materials being furnished under this Section. The fabrication and shop painting schedule is required to be received by the Owner at least two (2) weeks prior to the start of any fabrication. Failure to notify the Owner in sufficient advance of these procedures is grounds for rejection of the materials.

## PART 3 EXECUTION

### .01 ERECTION

- A. Fabricate and erect tank in accordance with latest edition of AWWA D100.

**B. Piping Connection:**

1. Provide temporary pipe connection for the filling and testing of the tank. Make permanent pipe connections, after monitoring of settlement is complete, and the Engineer has given approval to do so.

**.02 FIELD QUALITY CONTROL****A. Inspection**

1. At completion of welding, have at least one spot radiograph taken in the field on four sides of every plate below overflow elevation. Consider spot radiographs required by AWWA D100 as a part of above requirements.
2. All bottom plates to be tested by air pressure or vacuum method in accordance with AWWA D100.
3. Submit a report on radiograph inspections to Engineer. Report to include a layout sketch indicating location of radiographs with respect to plate edges, and Inspector's acceptance record for all radiographs.
4. If design incorporated AWWA D100 - Section 14, submit the required welding report by a certified welding inspector. Include certificate to purchaser of compliance with AWWA inspection requirements under Section 14 with report.

**B. Settlement Check**

1. Prior to filling tank, record elevations at quarter points along outside of foundation. Permanently mark points for future reference. Record elevations to within 0.01 ft. using the site benchmark from construction.
2. Submit documentation of all elevations taken along with a foundation plan showing point locations, oriented to north and referenced to major tank appurtenances, sealed by a registered land surveyor.

**C. Leak Test**

1. Check for leaks on tank surfaces during the filling process. Fix any leaks to the satisfaction of the Owner.

**END OF SECTION 15410**



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## SECTION 15420

### WATER STORAGE TANK PAINTING

#### PART 1 GENERAL

##### .01 SCOPE

- A. Section Includes Surface preparation, shop priming, and field coating for interior wet, interior dry, and exterior surfaces of steel water storage tank.

#### PART 2 PRODUCTS

##### .01 PAINT MATERIALS

- A. CONTRACTOR shall furnish one of the alternate proprietary systems EQUAL TO the TNE MEC Company, Inc. systems specified herein. All coatings shall be supplied by one coating manufacturer. Approved coating manufacturers are listed as follows:
  - 1. Keeler and Long, Inc., P. O. Box 460, Watertown, Connecticut 06795.
  - 2. M.A. Bruder & Sons, Inc., Pennsbury Division, 600 Reed Road, Broomall, Pennsylvania 19008.
  - 3. Sherwin Williams Corporation, 101 Prospect Avenue, N.W., Cleveland, Ohio, 44115.
  - 4. Tnemec Company, Inc., P. O. Box 1749, Kansas City, Missouri 64141
  - 5. Carboline Company, 350 Hanley Industrial Court, St. Louis, Missouri, 63144.

##### .02 FLEXIBLE SEALANT

- A. Flexible sealant shall be Sikaflex-1A. Sealant color shall be white for all interior applications.

##### .03 ABRASIVES

- A. Abrasives used for blast cleaning shall be those mentioned in the specifications of the Steel Structures Painting Council. Particular attention shall be given to the maximum particle size requirements. Abrasives must





be selected to provide the recommended surface profile and degree of cleanliness required.

## **PART 3 EXECUTION**

### **.01 SURFACE PREPARATION**

- A. SHOP: All steel surfaces shall be prepared in the shop in accordance with Steel Structures Painting Council SSPC-SP10 "Near White Blast Cleaning". Steel shall be thoroughly cleaned of rust, mill scale, dirt and all other foreign substances.
- B. INSPECTION: Shop primed surfaces shall be inspected in the field after tank erection and approved by the paint manufacturer prior to the application of any field coatings. The coating manufacturer shall verify the primer thickness and adhesion. Failure of the shop primer to meet manufacturer's requirements shall be sufficient cause for removal of the shop primer, recleaning and application of a field prime coat at no additional expense to the AW. Recoat windows shall be adhered to and/or proper procedures followed if maximum recoat time frames are exceeded.
- C. Field:
  - 1. Prior to any field coating application, all unused brackets shall be removed from the interior and exterior surfaces. All underlying areas shall be ground smooth. All weld burrs, weld spatter, scars and rough edges shall be ground smooth.
  - 2. All weld seams and any rusted or abraded areas, including rust bloom shall be field prepared, as required.
  - 3. Where necessary, steel surfaces shall be prepared in the field in accordance with Steel Structures Painting Council SSPC-SP10 "Near White Blast Cleaning".
- D. Contractor shall be responsible for any dust, debris and/or paint droplets which leave the AW's property and/or cause damage to neighboring property. Insufficient containment of abrasive debris and/or generation of nuisance dust beyond the AW's property limits is just cause for shut-down of the job until proper protective measures are in place and violations have been remedied.



- E. After any and all surface preparation, shop and field, all surfaces shall be thoroughly and completely cleaned of any residue or dust before applying sealer or primer, shop or field coatings.

## .02 SHOP PRIMING

- A. Fabricated steel plates may be shop primed, subject to all of the requirements of this Division. contractor is required to notify the AW at least two weeks in advance of any shop painting. AW reserves the right to inspect, or have an authorized representative present to inspect all shop coating operations. Failure to provide proper notification in advance of shop coating is cause for rejection of the primer coat and grounds for complete removal and repainting in the field, at no additional cost to the AW.
- A. If applicable, contractor shall apply the specified primer in the shop, in accordance with manufacturer's recommendations. Steel plates shall be primed leaving a four inch margin along all edges that are to be welded. **ANY PRIMER APPLIED TO AREAS THAT ARE TO BE WELDED MUST BE REMOVED IN THE FIELD PRIOR TO WELDING. WELDING OF PAINTED SURFACES WILL NOT BE PERMITTED.**

## .03 SEALER APPLICATION

- A. After cleaning, rough weld areas, areas where sealing is required or depressions where paint will not properly fill the voids, shall be sealed with an epoxy seam sealer recommended by the respective paint manufacturer as listed below. The seam sealer shall be applied only after blast cleaning and prior to coating application.
- B. Seam sealer will be applied at the roof and shell manholes, vent to shell intersection and all piping connections, unless seal welding of the area has been performed.
  - 1. Keeler and Long - (Not available)..
  - 2. M.A. Bruder & Sons, Inc. - 55-G-155 Seam Sealer.
  - 3. Sherwin Williams - Steel Seam Trowel Grade 920-W-979.
  - 4. Tnemec Company, Inc. - 63-1500 Filler and Surfacer.
  - 5. Carboline - (Not Available).



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## .04 PAINT SYSTEMS

- A. The coating systems listed below are proprietary to TNEMEC Company, Inc. Equal systems furnished by the manufacturers listed in Part 2.01 above will be acceptable upon review and approval by AW. All coatings and thinners must be supplied by one manufacturer, including shop coating. All paint must be new and purchased for this job.
- B. **INTERIOR WET AREAS:** Interior wet surfaces are any surfaces exposed to stored water *or its vapor*. Interior wet areas shall be coated with a three coat high-build epoxy system, NSF approved for use in potable water. The minimum dry film thickness of the interior coating system shall be 11mils. Manufacturers' recommended curing times and recoat windows between each coat must be strictly adhered to.
1. Three-coat high-build epoxy system manufactured by Tnemec Company, Inc.
    - a. Primer Coat - Tnemec Series 20-44BR Beige Pota-Pox, to a dry film thickness of 3.0 to 5.0 mils. Primer at weld seams to be applied by brush. Allow 12 hours before handling or recoating.
    - b. Intermediate Coat - Tnemec Series 20-39BL Delft Blue Pota-Pox, to a dry film thickness of 4.0 to 5.0 mils. Allow 24 hours before recoating.
    - c. Finish Coat - Tnemec 20-15BL Tank White Pota-Pox , to a dry film thickness of 4.0 to 5.0 mils.
- C. **EXTERIOR SURFACES:** Exterior surfaces are all surfaces exposed to the weather. Exterior surfaces shall be coated with a three coat high-build epoxy-polyurethane system. The minimum dry film thickness of the exterior coating system shall be 9.0 mils. Manufacturers' recommended curing times and recoat windows between each coat shall be strictly adhered to.
1. Three-coat high-build epoxy-polyurethane system manufactured by Tnemec Company, Inc.:
    - a. Primer Coat - Tnemec Series 66-44BR Beige , to a dry film thickness of 3.0 to 5.0 mils. Coating at weld seams to be applied by brush. Allow 12 hours before handling or recoating.
    - b. Intermediate Coat - Tnemec Series 66, (color later) to a dry film thickness of 4.0 to 5.0 mils. Allow 24 hours before recoating.



- c. Finish Coat - Tnemec Series 1075 Acrylic Polyurethane, (color later), to a dry film thickness of 2.0 to 3.0 mils.

#### .05 FLEXIBLE SEALANT

- A. After final curing of the finish interior coat, a flexible polyurethane sealant shall be applied to the roof stiffener-to-roof interfaces, if any, the circumferential stiffener angle-to-roof plate intersection, the unwelded roof lap seams and at the center hub connections or any other areas which are difficult to paint and subject to corrosion and movement. Sealant shall be applied in accordance with all manufacturer's recommendations and in a neat and workmanlike manner. Sealant shall be approved for use in potable water and shall be certified by USEPA, ANSI/NSF and any applicable local health regulatory agencies.

#### .06 INSPECTION

- A. All cleaning and painting shall be subject to inspection by a designated representative of AW and/or the paint manufacturer.
- B. The contractor shall make all work accessible to AW'S representative by having available the appropriate rigging and equipment. Any rigging removed prior to proper inspection and approval shall be reinstalled at the contractor's expense. This shall also apply at the one year anniversary inspection.
- C. The contractor will have available at the site an Elcometer or Mikrotest gauge for measuring dry film thickness and uniformity of the paint coating. AW may elect to use a low voltage holiday detector to check the finished paint film integrity.

#### 3.07 CURING

- A. The tank shall remain empty with all hatches and vents open for a minimum of seven days following the last coating operations. Forced air ventilation shall be provided, if deemed necessary by AW, to facilitate complete and timely curing.
- B. Following the recommended curing time, AW'S representative, along with a representative of the paint manufacturer will perform testing to insure that the coatings are properly cured. At a minimum, pencil hardness tests and MEK rub tests will be conducted. The contractor is required to obtain from the paint manufacturer certification that the coatings have been applied in accordance with all recommendations and are in a proper state of cure prior to disinfection and filling of the tank.



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- C. Disinfection of the tank will be performed in accordance with Specification Section 15430. The contractor shall be responsible for disinfection of the tank upon completion of the touch-up repairs.

**END OF SECTION 15420**



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## SECTION 15430

### WATER STORAGE TANK DISINFECTION

#### PART 1 GENERAL

##### .01 SCOPE

- A. The contractor shall clean and disinfect the water storage tank after all work has been completed and inspected and prior to placing the tank into service. This section will also apply upon completion of the one-year anniversary inspection.

##### .02 SUBMITTALS

- A. Prior to performing any disinfection procedure, contractor will be required to submit his proposed method of disinfection, including the exact type and amount of disinfecting agent to be used with a specific volume of water, the tools and methods of application and the intended amount of residual chlorine. The contractor is responsible to satisfy AW that the persons performing the disinfection procedure are qualified and have been trained in the appropriate safety measures.

##### .03 PROTECTION

- A. Due to the toxicity of chlorine fumes, men performing work under this Section should be equipped with the appropriate respiratory protection and personal protective equipment and should be attended by other personnel who are in the vicinity where work is to be performed.

#### PART 2 PRODUCTS

##### .01 MATERIALS AND EQUIPMENT

- A. Furnish chlorine gas and injection equipment and/or calcium hypochlorite (HTH) as needed to complete the disinfection of the tank.
- B. Furnish pumps, hose, nozzle and other equipment for spraying and washing the interiors of the tank.
- C. Provide NSF Standard 60 certified products per Listing of Certified Drinking Water Treatment Chemicals - Health Effects.



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## PART 3 EXECUTION

### .01 COORDINATION

- A. The contractor must notify AW at least seven days in advance of the disinfection procedure to allow AW adequate time to arrange the necessary operations modifications for refilling the tank promptly upon completion of the disinfection procedure.
- B. The contractor will not discharge any chlorinated rinse water from the tank prior to coordination with AW.

### .02 PREPARATION

- A. All interior painting shall be completed in the tank prior to cleaning and disinfection of the tank. The steel tank should remain empty for a minimum period of seven (7) days with all manholes, hatches, drains and plugs, etc., open to permit paint fumes to escape.
- B. Following the seven day period, provisions should be made to perform the rinsing operation. The following equipment will be needed:
  - 1. A pump of sufficient capacity to supply enough water for spray rinsing.
  - 2. A length of fire hose and a nozzle for spraying. On elevated tanks the hose should extend up through the riser to the tank.
  - 3. Sufficient water supply to thoroughly rinse all interior surfaces.
- C. The interior surfaces should be thoroughly rinsed and particular attention should be given to laps, crevices, corners or any areas in which the solid material might collect. The rinse water should be drained to waste.

### .03 APPLICATION OF DISINFECTANT

- A. Application of disinfectant shall be performed in accordance with chlorination methods set forth in the current ANSI/AWWA C652-92 *Disinfection of Water Storage Facilities*.

### .04 TESTING

- A. Bacteriological tests will be made by the AW. Tanks will not be accepted and placed into service until the results of the bacteriological tests are acceptable by AW
- B. Should the initial treatment prove to be ineffective, in the opinion of the AW, the contractor shall repeat the chlorination procedure until satisfactory results are obtained.



- C. Volatile Organic Compound (VOC) Tests: At least one sample shall be tested by the Contractor for all currently regulated or proposed to be regulated volatile organic compounds in accordance with currently accepted EPA methods published in 40 CFR part 141 and EPA 600/4-79-020. Measured levels shall not exceed the Maximum Contaminate Level (MCL) for VOCs as established by the National Primary Drinking Water Standard. Testing which does not meet the MCL will be retested. If further retests are not satisfactory, corrective actions shall be made to comply with the MCL at no cost to the Owner.

**END OF SECTION 15430**





## SECTION 15500

### WATER WELL DRILLING, CASING AND GRAVEL INSTALLATION, DEVELOPMENT AND TESTING

#### PART 1 GENERAL

##### .01 SCOPE

- A. The contractor shall furnish all labor, tools, equipment, and material. Contractor shall perform all operations as required to install a water well, including, but not limited to, drilling, construction of potable water lines (wells and pumps), casing, screening, underground storage tanks, booster pumps, controls, well pump, and all necessary system electrical wiring.

##### .02 SUBMITTALS

- A. Submit shop drawings and manufacturer's literature to the Engineer for approval in accordance with Specification Section 1300.
- B. Special materials and products to be used in well drilling and development shall be approved by the Engineer prior to use in accordance with Specification Section 1300.

##### .03 SPECIAL REQUIREMENTS

- A. The well is to be drilled to the depth necessary to produce the required flow and water quality to meet all applicable Federal, State, and Local standards.
- B. Well drilling, development, testing, and cleaning equipment shall be furnished by the Contractor at no additional cost to the Owner.

#### PART 2 PRODUCTS

##### .01 WELL PUMP

- A. The well shall be provided with a submersible pump capable of meeting the design point set forth in the project specifications.
- B. The pump shall be set on NSF approved 1-1/2" SDR 26 PVC pipe.

**.02 BOOSTER PUMP/PRESSURE TANK**

A. Furnish chlorine gas and injection equipment and/or calcium hypochlorite (HTH) as needed to complete the disinfection of the tank.

**.03 CHLORINATOR**

A. Furnish chlorine gas and injection equipment and/or calcium hypochlorite (HTH) as needed to complete the disinfection of the tank.

**.04 PUMP HOUSE**

A. Furnish chlorine gas and injection equipment and/or calcium hypochlorite (HTH) as needed to complete the disinfection of the tank.

**.05 WATER METER**

A. Furnish chlorine gas and injection equipment and/or calcium hypochlorite (HTH) as needed to complete the disinfection of the tank.

**.06 UNDERGROUND WATER STORAGE TANK**

A. Furnish chlorine gas and injection equipment and/or calcium hypochlorite (HTH) as needed to complete the disinfection of the tank.

**.07 WATER LINES**

A. Furnish chlorine gas and injection equipment and/or calcium hypochlorite (HTH) as needed to complete the disinfection of the tank.

**.08 ELECTRICAL CONNECTIONS**

A. Furnish chlorine gas and injection equipment and/or calcium hypochlorite (HTH) as needed to complete the disinfection of the tank.

**PART 3 EXECUTION****.01 COORDINATION**

A. The contractor must notify AW at least seven days in advance of the disinfection procedure to allow AW adequate time to arrange the necessary operations modifications for refilling the tank promptly upon completion of



the disinfection procedure.

- B. The contractor will not discharge any chlorinated rinse water from the tank prior to coordination with AW.

## .02 PREPARATION

- A. All interior painting shall be completed in the tank prior to cleaning and disinfection of the tank. The steel tank should remain empty for a minimum period of seven (7) days with all manholes, hatches, drains and plugs, etc., open to permit paint fumes to escape.
- B. Following the seven day period, provisions should be made to perform the rinsing operation. The following equipment will be needed:
  - 1. A pump of sufficient capacity to supply enough water for spray rinsing.
  - 2. A length of fire hose and a nozzle for spraying. On elevated tanks the hose should extend up through the riser to the tank.
  - 3. Sufficient water supply to thoroughly rinse all interior surfaces.
- C. The interior surfaces should be thoroughly rinsed and particular attention should be given to laps, crevices, corners or any areas in which the solid material might collect. The rinse water should be drained to waste.

## .03 APPLICATION OF DISINFECTANT

- A. Application of disinfectant shall be performed in accordance with chlorination methods set forth in the current ANSI/AWWA C652-92 *Disinfection of Water Storage Facilities*.

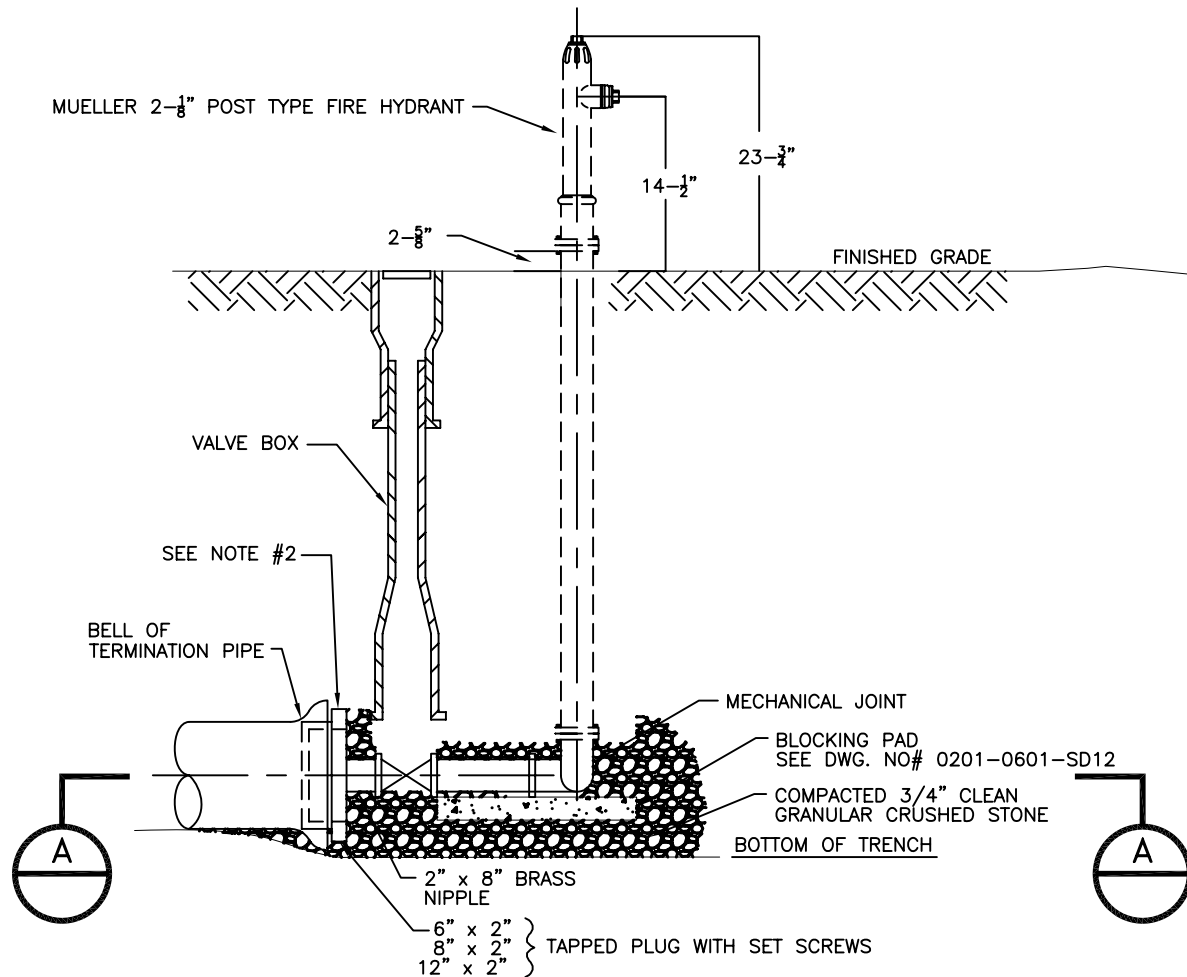
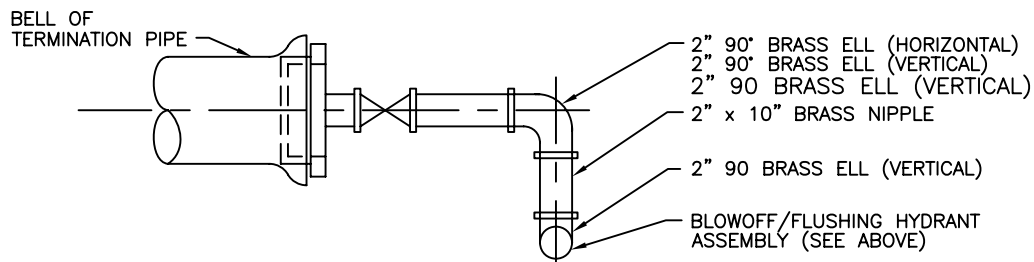
## .04 TESTING

- A. Bacteriological tests will be made by the AW. Tanks will not be accepted and placed into service until the results of the bacteriological tests are acceptable by AW
- B. Should the initial treatment prove to be ineffective, in the opinion of the AW, the contractor shall repeat the chlorination procedure until satisfactory results are obtained.
- C. Volatile Organic Compound (VOC) Tests: At least one sample shall be tested by the Contractor for all currently regulated or proposed to be regulated volatile organic compounds in accordance with currently accepted EPA methods published in 40 CFR part 141 and EPA 600/4-79-020. Measured levels shall not exceed the Maximum Contaminate Level (MCL) for VOCs as established by the National Primary Drinking Water Standard. Testing which does not meet the MCL will be retested. If further retests are not satisfactory, corrective actions shall be made to comply with the MCL at



no cost to the Owner.

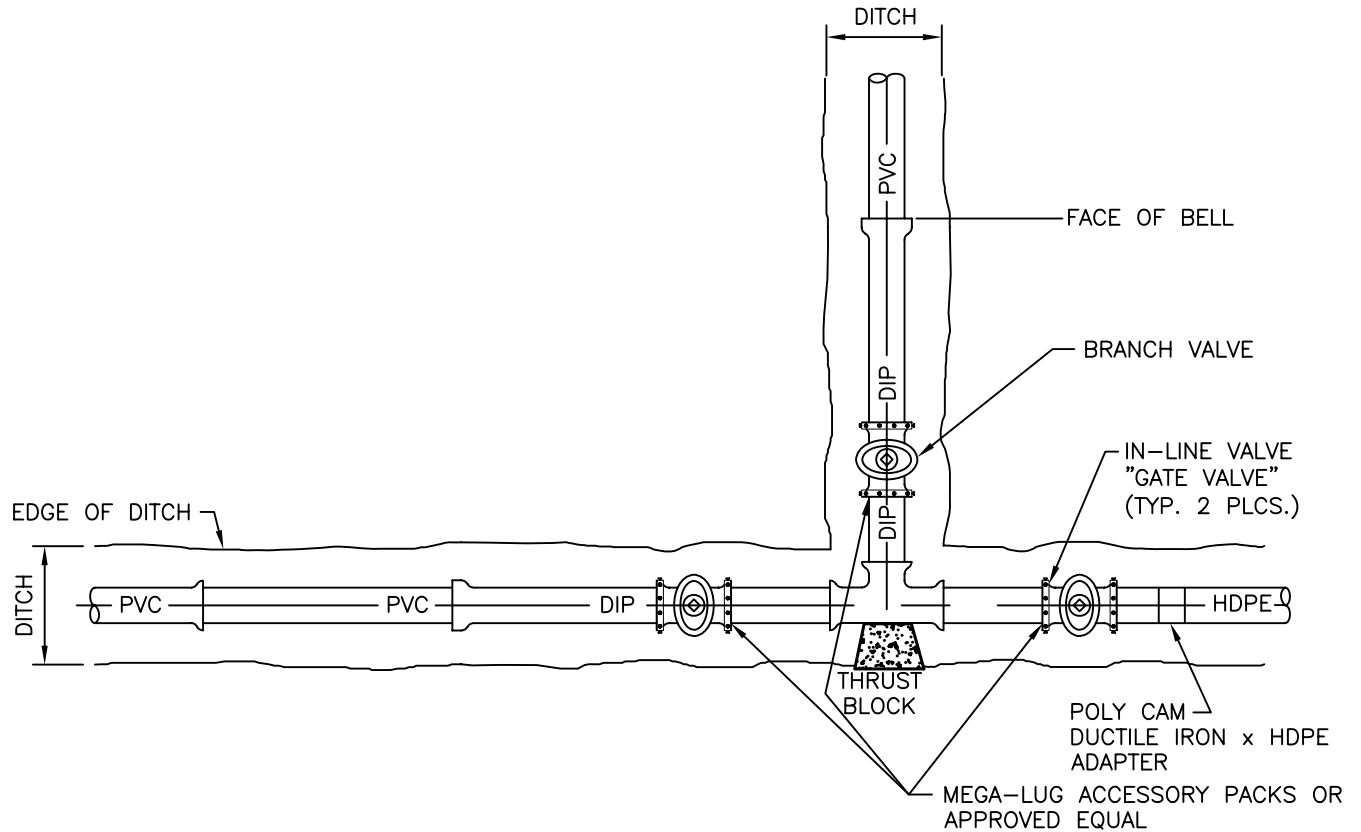
**END OF SECTION 15500**

**ELEVATION****SECTION A-A**

## NOTES:

1. POLYETHYLENE ENCASING ON ALL D.I. PIPE.
2. ENCASE OR COAT BRASS AS NEEDED.
3. SEE DWG. NO. 0201-0601-SD3 FOR RESTRAINT OF PLUG.

REVISIONS		AMERICAN WATER STANDARD CIVIL BLOWOFF/FLUSHING HYDRANT ASSEMBLY DETAIL	
7/07 - MSG EDITS		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
		DRAWN BY RJB PROJECT ENG'R APPROVED	DATE 08-14-06 PROJECT IP USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD1



## REVISIONS

7/07 - MSG EDITS

AMERICAN WATER STANDARD  
CIVIL  
DOUBLE IN-LINE x BRANCH VALVE BLOCKING  
FOR PVC WATER MAIN - DETAIL

AMERICAN WATER  
VOORHEES, NJ 08043

AMERICAN WATER ENG. CENTER  
213 CARRIAGE LANE  
DELRAN, NJ 08075



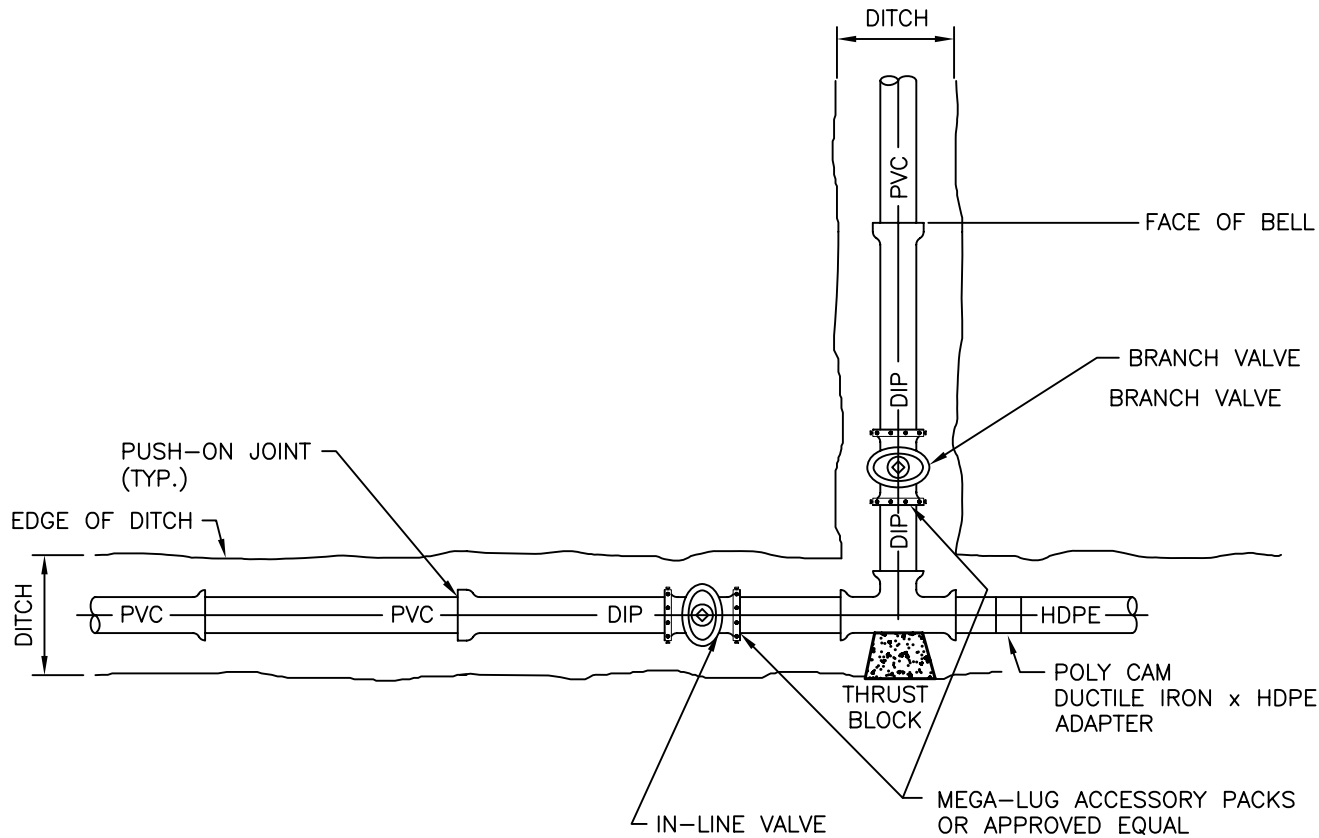
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PROJECT ENG'R  
APPROVED

DATE 07-31-06  
PROJECT IP

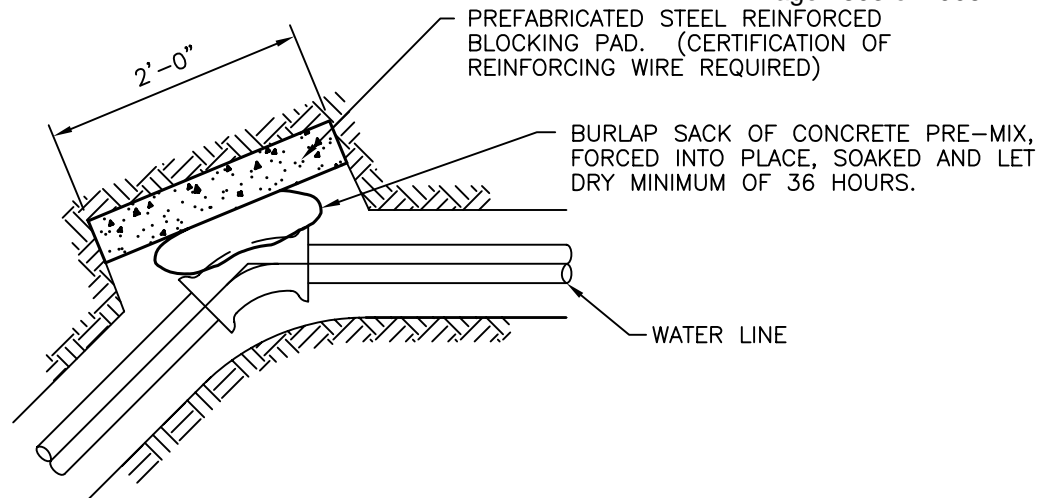
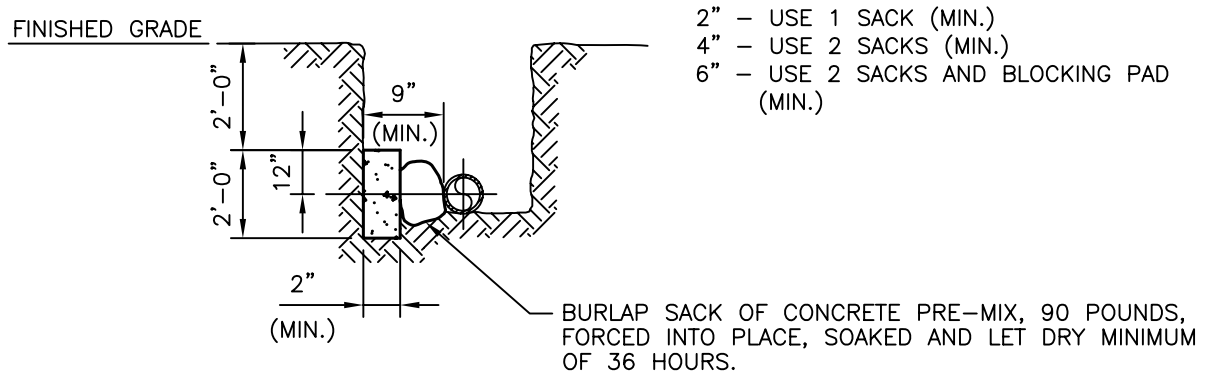
USE DIMENSIONS ONLY  
SCALE N.T.S.

USE APPROVED DRAWINGS ONLY  
FOR CONSTRUCTION PURPOSES


0201-0601-SD10



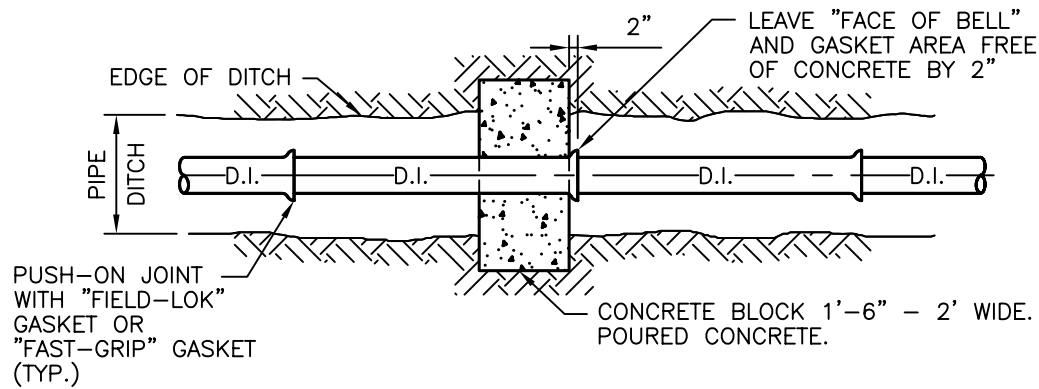
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7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 07-31-06 PROJECT IP	
		USE DIMENSIONS ONLY SCALE N.T.S.	
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD11

PLANELEVATION

(FOR 2", 4", AND 6" DIA. PIPE ONLY)

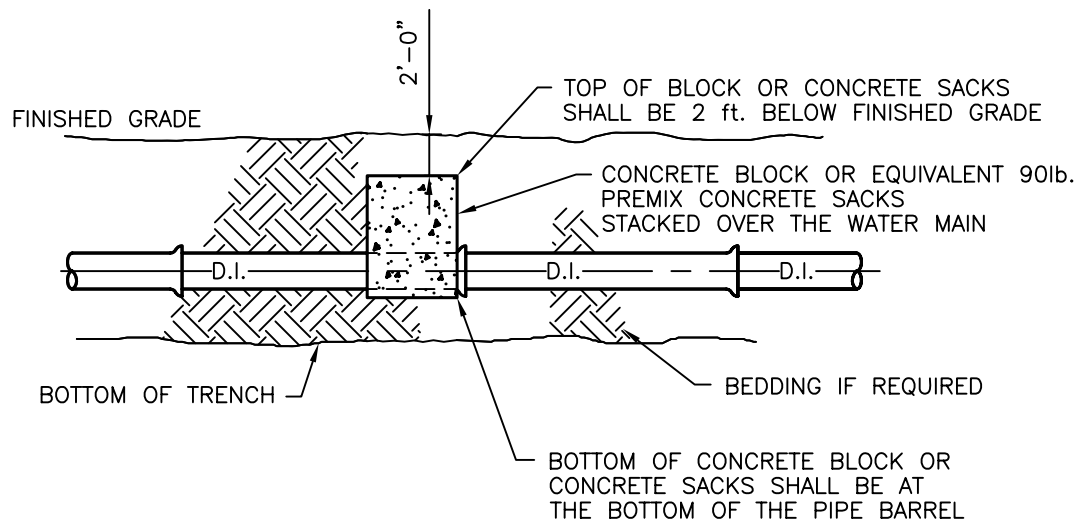
REVISIONS		AMERICAN WATER STANDARD CIVIL THRUST BLOCK AT HORIZONTAL BENDS 6" OR LESS – DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
			
DRAWN BY RJB PROJECT ENG'R APPROVED		DATE 07–31–06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES		0201–0601–SD17	





DITCH CHECK FOR SLOPES  
GREATER THAN 3.5:1


### PLAN

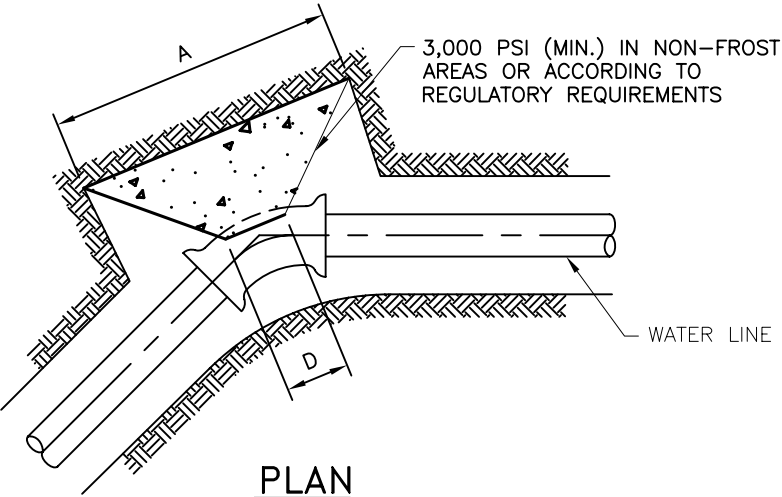


### ELEVATION

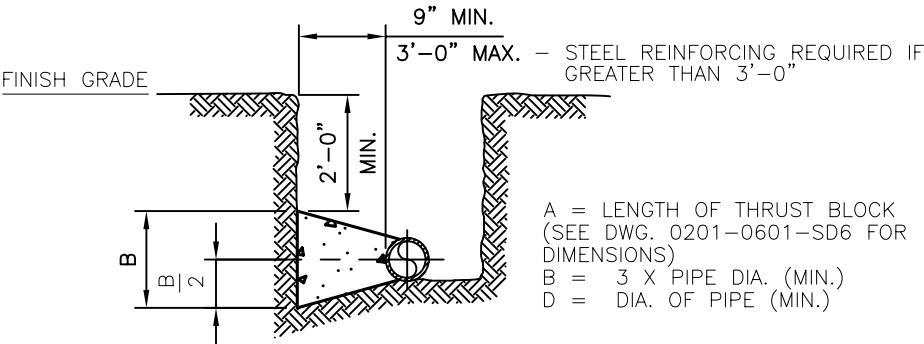
NOTE:

RESTRAINED JOINTS IS THE PREFERRED OPTION

REVISIONS		AMERICAN WATER STANDARD CIVIL DITCH CHECK FOR SLOPES GREATER THAN 3.5:1 – DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	 American Water
		DRAWN BY RJB PROJECT ENG'R APPROVED	DATE 07–31–06 PROJECT IP USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD18



PLAN




ELEVATION

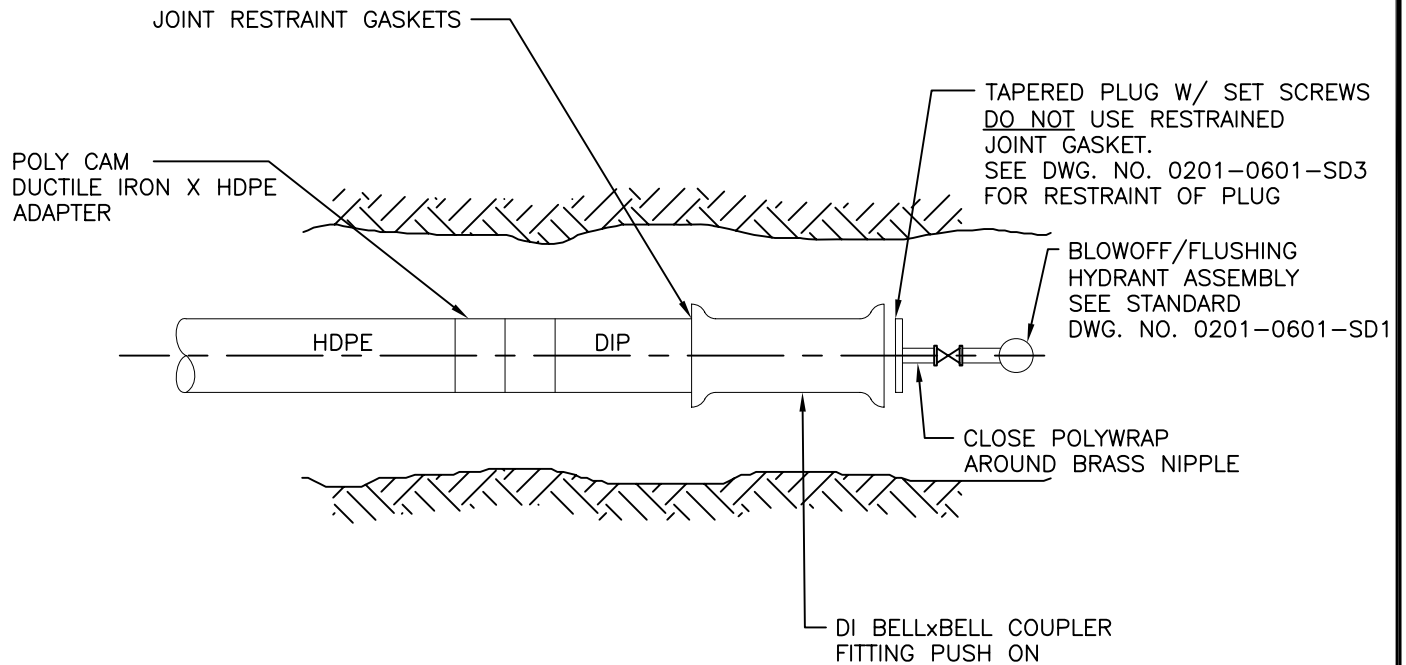
\* BEARING AREAS ARE BASED ON SOIL HAVING AN ALLOWABLE SAFE LATERAL BEARING OF 2000 POUNDS PER SQUARE FOOT AND 200 PSI TEST PRESSURE. AREA MUST BE REVISED FOR SOILS WITH A LOWER BEARING CAPACITY OR HIGHER TEST PRESSURE.

GENERAL NOTES:


1. COVER OVER TOP OF PIPE SHALL BE BELOW FROST LINE MINIMUM 30". IF GRADING PLANS RECEIVED BY THE ENGINEER/OWNER WITH THE REQUEST FOR WATER MAIN LAYOUT, INDICATE ADJUSTMENTS TO EXISTING GRADE, THEN PIPE SHALL BE INSTALLED TO MEET MINIMUM AND MAXIMUM COVER FROM PROPOSED GRADES SHOWN ON SAID PLANS.
2. THRUST BLOCKS SHALL BE BUILT AGAINST UNDISTURBED SOIL WITH ADEQUATE BACKING TO PREVENT MOVEMENT OF FITTING.
3. NO THRUST BLOCKS TO BE PLACED IN SEWER LATERAL DITCHES,.
4. THRUST BLOCKING MUST FIT IN EASEMENT, IN SOME CASES ADDITIONAL RESTRAINT MAY BE REQUIRED.
5. DIMENSION "A" BASED ON MINIMUM BEARING AREA.
6. POLYETHYLENE ENCASEMENT AND MJ FITTINGS WITH RETAINER GLANDS ON ALL D.I. PIPE AND FITTINGS.
7. PIPE JOINTS AND BOLTS MUST BE ACCESSIBLE.
8. ALL ANCHOR BOLTS SHALL BE GALVANIZED STEEL, MINIMUM 1/2" DIAMETER. COAT EXPOSED ROD WITH APPROVED MATERIAL AFTER CONCRETE HAS SET.
9. ALLOW SUFFICIENT CLEARANCE BETWEEN CONCRETE AND BOLTS FOR FUTURE MAINTENANCE.
10. ALL M.J. AND FLG. FITTINGS TO RECEIVE THRUST BLOCKS SHALL HAVE THE FASTENER AREAS KEPT FREE OF CONCRETE TO ALLOW FUTURE ACCESS TO THE FASTENERS AT THE JOINTS.
11. THRUST BLOCKING DETAILS ARE SHOWN HERE FOR TYPICAL INSTALLATIONS. IN SOME CASES, ADDITIONAL RESTRAINT MAY BE REQUIRED.
12. PORTLAND CEMENT CONCRETE USED FOR THRUST BLOCKS SHALL BE 300 PSI CONCRETE (MIN.).

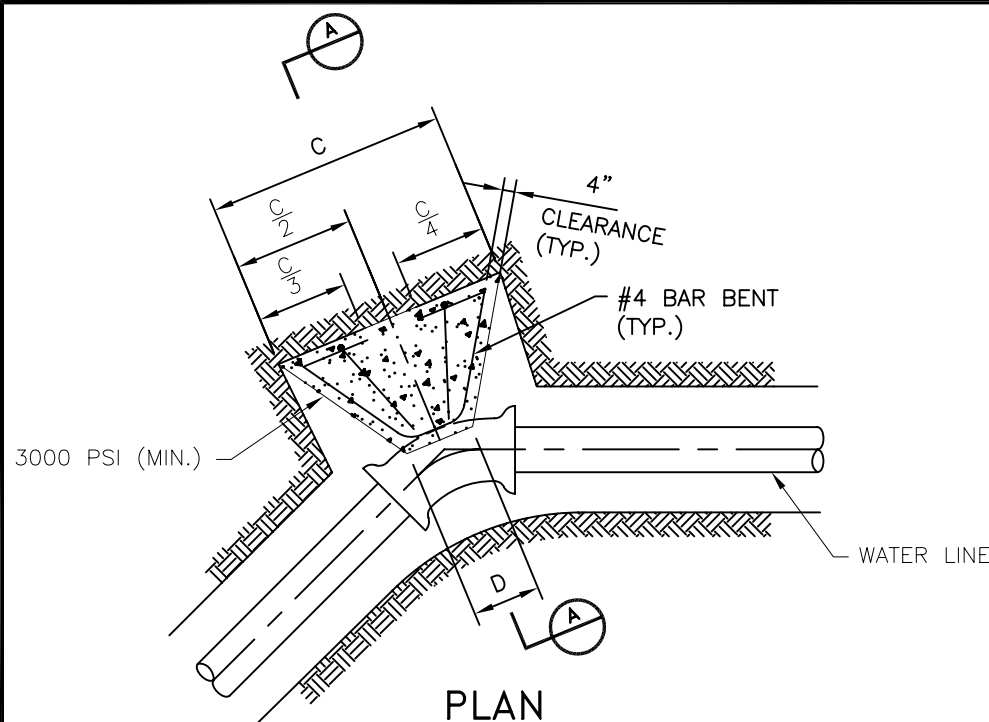
0201-0601-SD19

REVISIONS		AMERICAN WATER STANDARD CIVIL THRUST BLOCK AT HORIZONTAL BENDS (LESS THAN 3 FEET IN THICKNESS)-DETAIL	
7/07 - MSG EDITS		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075 	
		DRAWN BY RJB PROJECT ENG'R APPROVED	DATE 08-01-03 PROJECT IP USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD19



PLAN

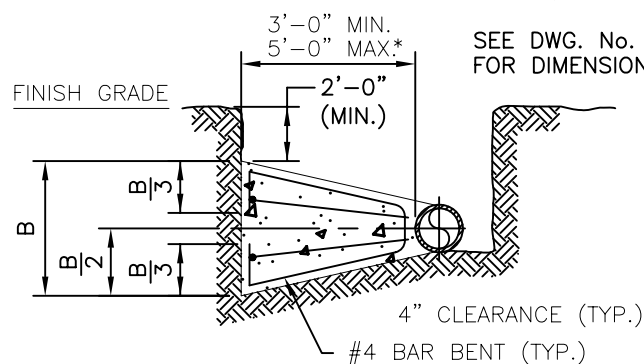
REVISIONS		AMERICAN WATER STANDARD CIVIL HDPE FLUSH VALVE DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		<div>AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075</div> <div></div>	
		DRAWN BY RJB PROJECT ENG'R APPROVED	DATE 08–14–06 PROJECT IP USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES.	0201–0601–SD2



## PLAN

$$B=3 \times D(\text{PIPE DIAMETER})$$

SEE DWG. No. 0201-0601-SD6  
FOR DIMENSIONS



\* SPECIAL DESIGN REQUIRED IF GREATER THAN 5'-0"


SECTION A-A

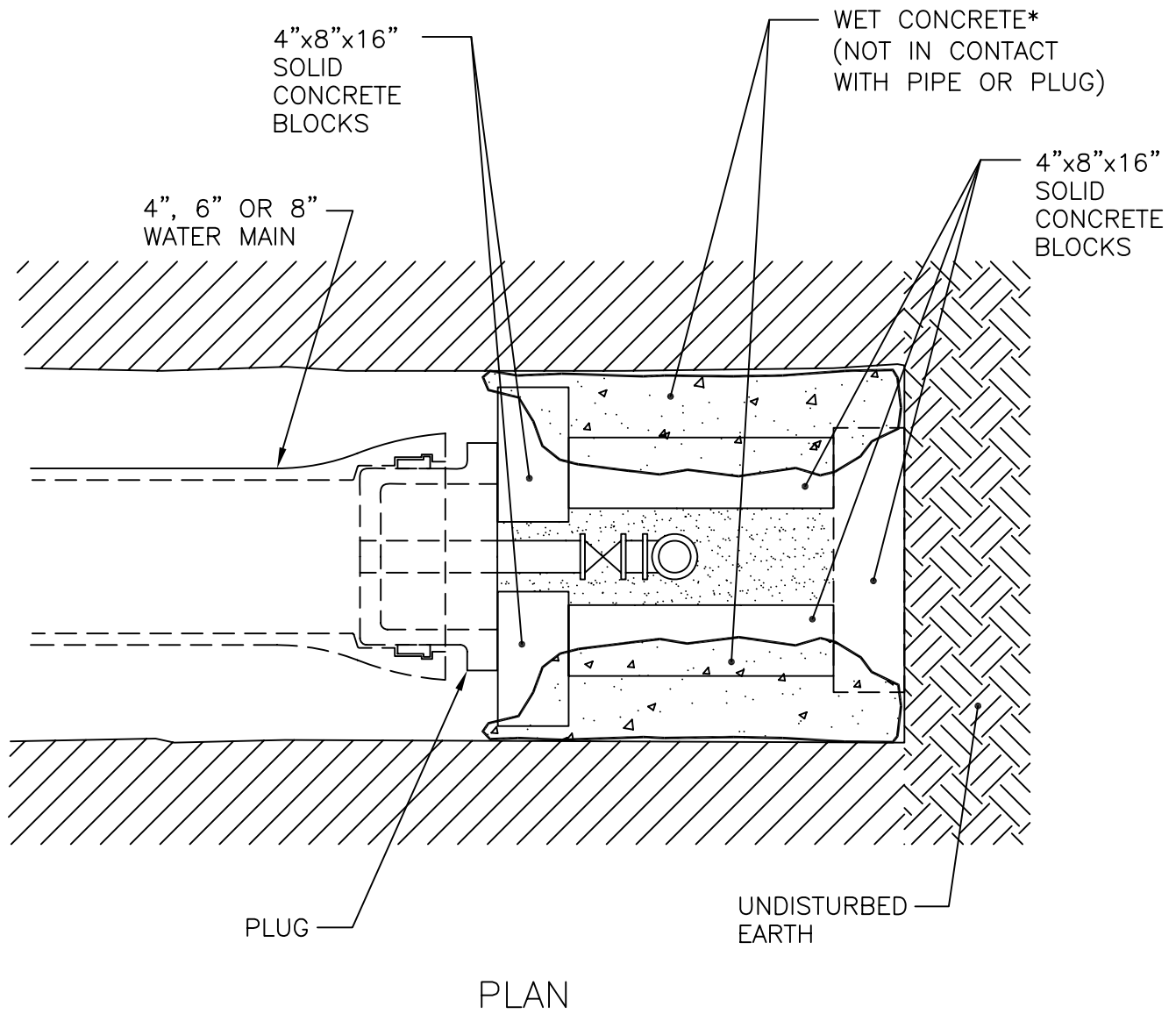
N.T.S.

\* BEARING AREAS ARE BASED ON SOIL HAVING AN ALLOWABLE SAFE LATERAL BEARING OF 2000 POUNDS PER SQUARE FOOT AND 200 PSI TEST PRESSURE. AREA MUST BE REVISED FOR SOILS WITH A LOWER BEARING CAPACITY OR HIGHER TEST PRESSURE.


GENERAL NOTES:

1. COVER OVER TOP OF PIPE SHALL BE BELOW FOST LINE OR 30" MINIMUM IN NON-FROST AREAS OR ACCORDING TO REGULATORY REQUIREMENTS. IF GRADING PLANS RECEIVED BY THE ENGINEER/OWNER WITH THE REQUEST FOR WATER MAIN LAYOUT, INDICATE ADJUSTMENTS TO EXISTING GRADE, THEN PIPE SHALL BE INSTALLED TO MEET MINIMUM AND MAXIMUM COVER FROM PROPOSED GRADES SHOWN ON SAID PLANS.
2. THRUST BLOCKS SHALL BE BUILT AGAINST UNDISTURBED SOIL WITH ADEQUATE BACKING TO PREVENT MOVEMENT OF FITTING.
3. NO THRUST BLOCKS TO BE PLACED IN SEWER LATERAL DITCHES,.
4. THRUST BLOCKING MUST FIT IN EASEMENT, IN SOME CASES ADDITIONAL RESTRAINT MAY BE REQUIRED.
5. DIMENSION "C" BASED ON MINIMUM BEARING AREA.
6. POLYETHYLENE ENCASEMENT AND MJ FITTINGS WITH RETAINER GLANDS ON ALL D.I. PIPE AND FITTINGS.
7. PIPE JOINTS AND BOLTS MUST BE ACCESSIBLE.
8. ALL ANCHOR BOLTS SHALL BE GALVANIZED STEEL, MINIMUM 1/2" DIAMETER. COAT EXPOSED ROD WITH APPROVED MATERIAL AFTER CONCRETE HAS SET.
9. ALLOW SUFFICIENT CLEARANCE BETWEEN CONCRETE AND BOLTS FOR FUTURE MAINTENANCE.
10. ALL M.J. AND FLG. FITTINGS TO RECEIVE THRUST BLOCKS SHALL HAVE THE FASTENER AREAS FELT WRAPPED AND TAPED PRIOR TO THE CONCRETE POUR TO ALLOW FUTURE ACCESS TO THE FASTENERS AT THE JOINTS.
11. THRUST BLOCKING DETAILS ARE SHOWN HERE FOR TYPICAL INSTALLATIONS. IN SOME CASES, ADDITIONAL RESTRAINT MAY BE REQUIRED.
12. PORTLAND CEMENT CONCRETE USED FOR THRUST BLOCKS SHALL BE 3000 PSI CONCRETE MINIMUM.

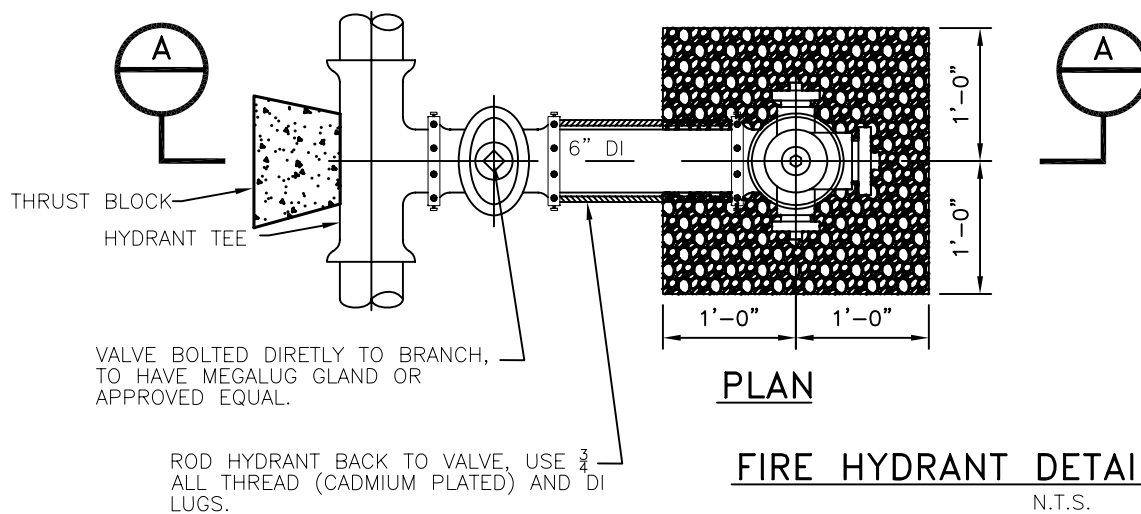
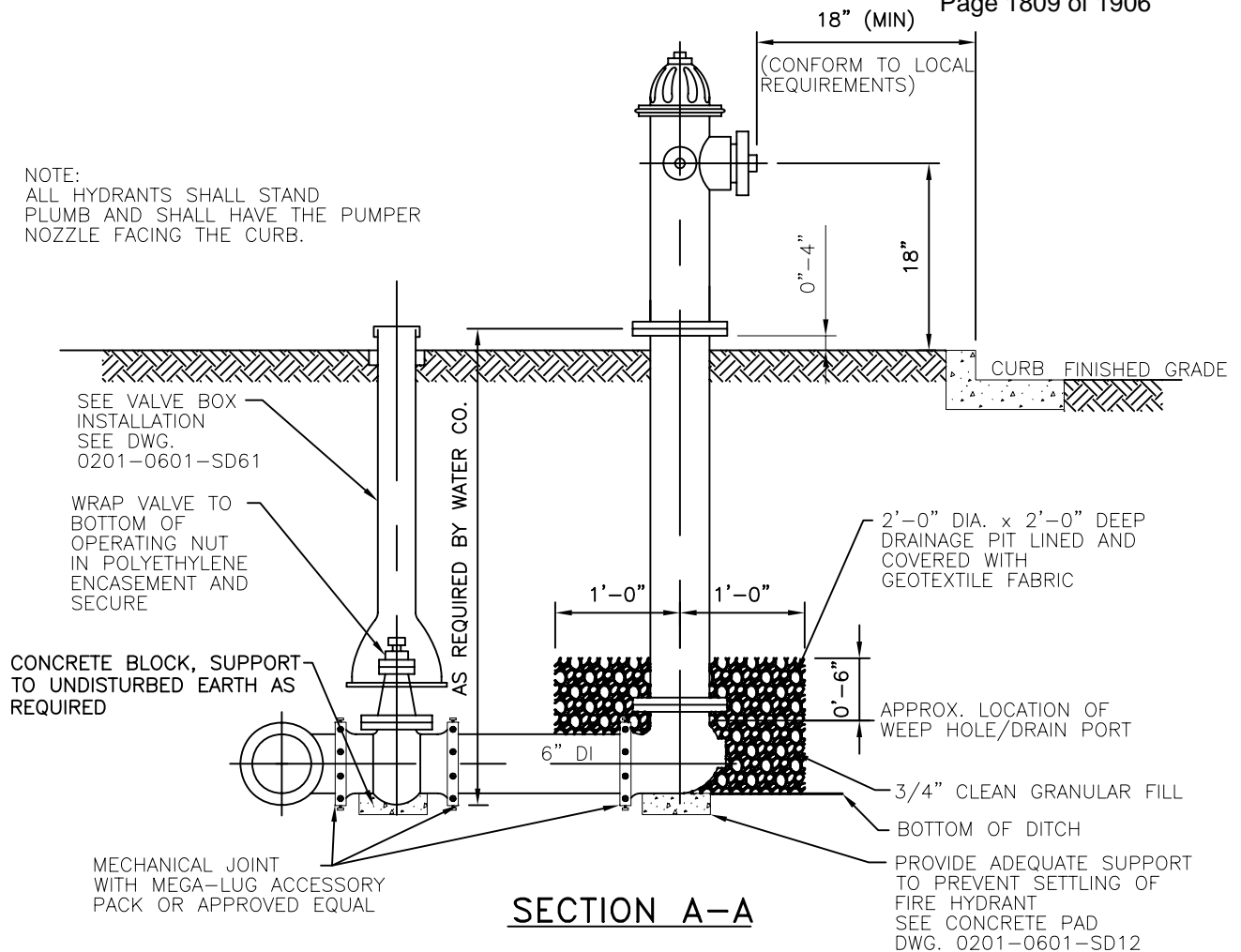
REVISIONS  7/07 - MSG EDITS	AMERICAN WATER STANDARD CIVIL THRUST BLOCK AT HORIZONTAL BENDS (EXCEEDING 3 FT. IN THICKNESS) - DETAIL	
	AMERICAN WATER VOORHEES, NJ 08043	
	AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	 American Water
	DRAWN BY RJB PROJECT ENG'R RESP. ENGINEER APPROVED	DATE 08-01-03 PROJECT IP USE DIMENSIONS ONLY SCALE N.T.S.
	USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD20



\* AT DISCRETION OF AW  
PROJECT MANAGER


REVISIONS		AMERICAN WATER STANDARD CIVIL BLOCKING AT END OF MAIN W/BLOW-OFF DETAIL	
7/07 - MSG EDITS		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075 	
		DRAWN BY RJB PROJECT ENG'R APPROVED	DATE 07-31-06 PROJECT IP
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	
		0201-0601-SD3	

NOTE:  
ALL HYDRANTS SHALL STAND  
PLUMB AND SHALL HAVE THE PUMPER  
NOZZLE FACING THE CURB.



## FIRE HYDRANT DETAIL—STANDARD

N.T.S.

<div> <div>REVISIONS</div> <div>7/07 – MSG EDITS</div> </div>	<div>AMERICAN WATER STANDARD CIVIL FIRE HYDRANT DETAIL</div>		
	<div>AMERICAN WATER VOORHEES, NJ 08043</div>		
	<div>AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075</div>	<div>  </div>	
	<div>DRAWN BY RJB PROJECT ENG'R APPROVED</div>	<div>DATE 07–31–06 PROJECT IP</div>	<div>USE DIMENSIONS ONLY SCALE N.T.S.</div>
	<div>USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES</div>	<div>0201–0601–SD31</div>	

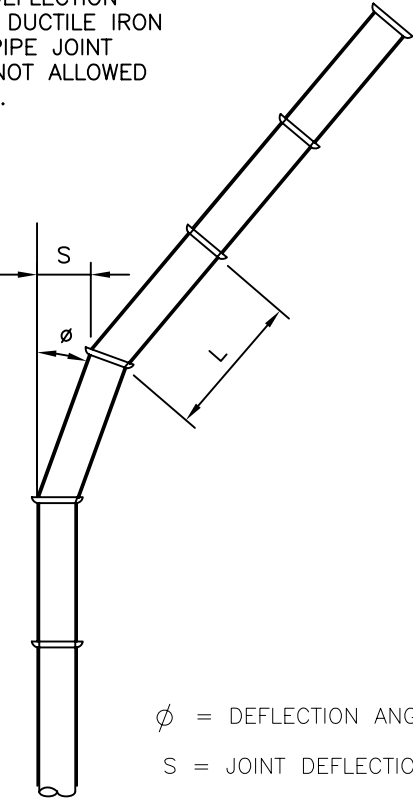
MAXIMUM JOINT DEFLECTION  
FULL-LENGTH PIPE-PUSH-ON TYPE JOINT PIPE

NOMINAL PIPE SIZE INCHES	DEFLECTION ANGLE DEGREES	MAX OFFSET -S INCHES		APPROX RADIUS OF CURVE - R PRODUCED BY SUCCESSION OF INCHES		CURRENT AW DEFLECTION ANGLE DEGREES
		L=18 FT	L=20 FT	L=18 FT	L=20 FT	
3	4	15	17	256	285	
4	4	15	17	256	285	
6	4	15	17	256	285	4
8	4	15	17	256	285	4
10	4	15	17	256	285	
12	4	15	17	256	285	4
14	4	9	10	256	285	
16	2.5	9	10	429	476	2.5
18	2.5	9	10	429	476	
20	2.5	9	10	429	476	2
24	2.5	9	10	429	476	1.5

MJ						
NOMINAL PIPE SIZE  INCHES	DEFLECTION ANGLE  DEGREES	MAX OFFSET -S  INCHES		APPROX RADIUS OF CURVE - R PRODUCED BY SUCCESSION OF  INCHES		CURRENT AW DEFLECTION ANGLE  DEGREES
		L=18 FT	L=20 FT	L=18 FT	L=20 FT	
		table deleted				
3	6.5	25	28	158	176	
4	6.5	25	28	158	176	
6	5.5	22	24	182	202	
8	4	16	18	256	285	
10	4	16	18	256	285	
12	4	16	18	256	285	
14	3	11	12	367	408	
16	3	11	12	367	408	
18	2.5	11	10	429	476	
20	2.5	9	10	429	476	
24	1.5	9	8	644	715	

Push pipe DI deflection										18	20
angle	18' deflection in inches	20' deflection in inches									
3	5	19	21	205	230	80%	80%	80%	tan angle/2	tan angle/2	
4	5	19	21	205	230	4	15.2	16.8	0.176327	0.140541	256.1533
6	5	19	21	205	230	4	15.2	16.8	0.176327	0.140541	256.1533
8	5	19	21	205	230	4	15.2	16.8	0.176327	0.140541	256.1533
10	5	19	21	205	230	4	15.2	16.8	0.176327	0.140541	256.1533
12	5	19	21	205	230	4	15.2	16.8	0.176327	0.140541	256.1533
14	5	11	12	205	230	4	8.8	9.6	0.176327	0.140541	256.1533
16	3	11	12	340	380	2.4	8.8	9.6	0.1051042	0.083972	428.7126
18	3	11	12	340	380	2.4	8.8	9.6	0.1051042	0.083972	428.7126
20	3	11	12	340	380	2.4	8.8	9.6	0.1051042	0.083972	428.7126
24	3	11	12	340	380	2.4	8.8	9.6	0.1051042	0.083972	428.7126
Push pipe DI deflection										18	20
angle	18' deflection in inches	20' deflection in inches									
3	8	31	35	125	240	80%	80%	80%	tan angle/2	tan angle/2	
4	8	31	35	125	240	6.4	24.8	28	0.2867454	0.227194	158.4546
6	7	27	30	145	160	6.4	24.8	28	0.2867454	0.227194	158.4546
8	5	20	22	195	220	5.6	21.6	24	0.249328	0.198005	181.8133
10	5	20	22	195	220	4	16	17.6	0.176327	0.140541	256.1533
12	5	20	22	195	220	4	16	17.6	0.176327	0.140541	256.1533
14	3.5	13.5	15	285	320	4	16	17.6	0.176327	0.140541	256.1533
16	3.5	13.5	15	285	320	2.8	10.8	12	0.1227846	0.098051	367.1564
18	3	13.5	12	340	380	2.8	10.8	12	0.1227846	0.098051	367.1564
20	3	11	12	340	380	2.4	10.8	9.6	0.1051042	0.083972	428.7126
24	2	11	10	450	500	2.4	8.8	9.6	0.1051042	0.083972	428.7126
						1.6	8.8	8	0.0699268	0.055909	643.9072

- NOTE:
- PIPE JOINT DEFLECTION ALLOWED ON DUCTILE IRON PIPE ONLY. PIPE JOINT DEFLECTION NOT ALLOWED ON PVC PIPE.




$\phi$  = DEFLECTION ANGLE  
S = JOINT DEFLECTION OFFSET  
L = LAYING LENGTH  
R = RADIUS OF CURVE  
 $R = \frac{L}{2 \tan \frac{\phi}{2}}$

NOTE:  
\*L-STANDARD LENGTH OF PIPE SECTION.

0201-0601-SD32

Information Only - Subject to Revision

REVISIONS		AMERICAN WATER STANDARD CIVIL PIPE CURVE GEOMETRY DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		<div>AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELTRAN, NJ 08075</div> <div> American Water</div>	
		<div>DRAWN BY RJB PROJECT ENG'R RESP. ENGINEER APPROVED</div> <div>DATE 08-01-03 PROJECT IP</div> <div>USE DIMENSIONS ONLY SCALE N.T.S.</div>	
		<div>USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES</div> <div>0201-0601-SD32</div>	

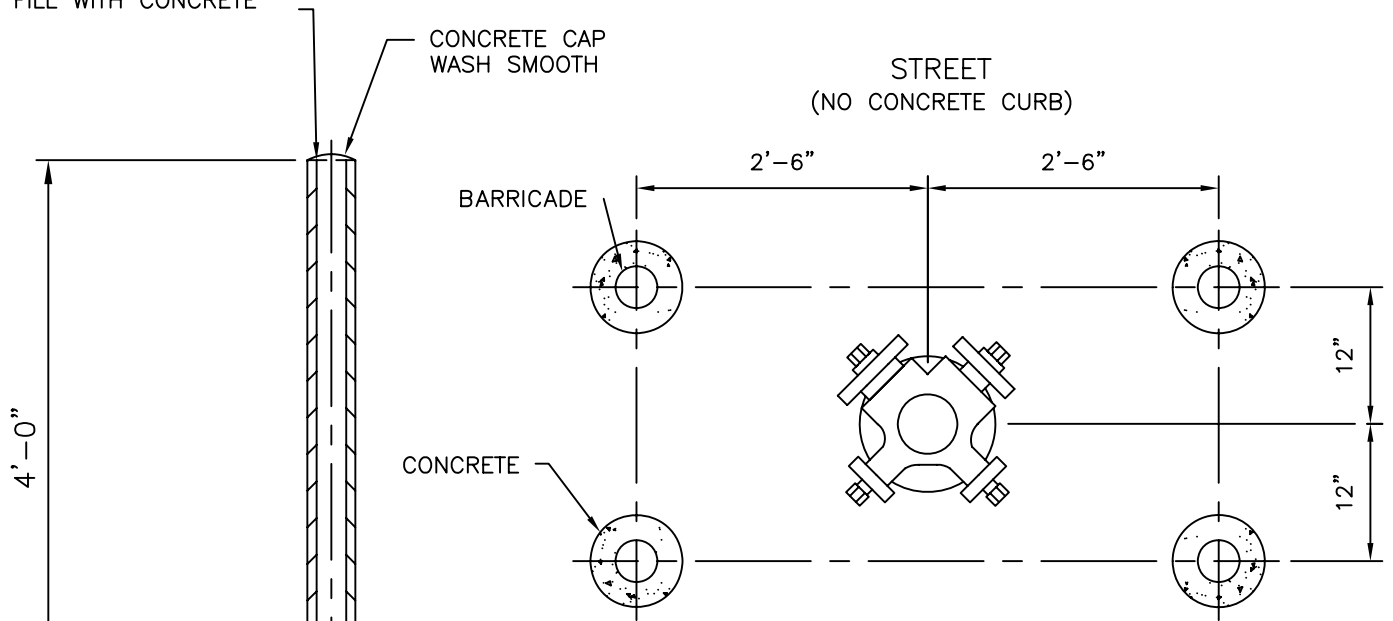
FINAL

0201-0601-SD32

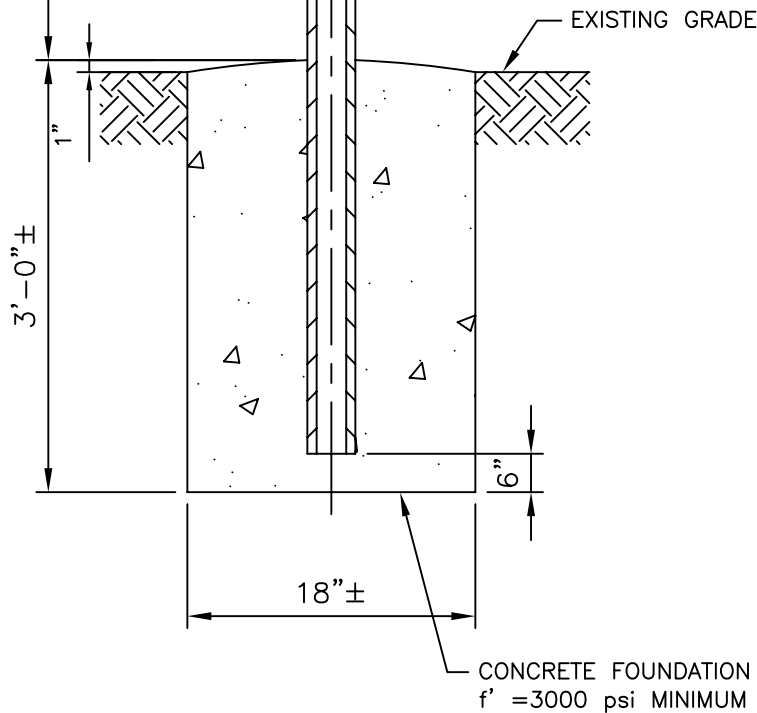
Section: Appendix JJ  
 4" SCH. 80 STEEL OR DI PIPE  
 PAINT SAFETY YELLOW (2 COATS)  
 FILL WITH CONCRETE

W912DR-12-R-0017-N/A

Page 1811 of 1906




PLAN



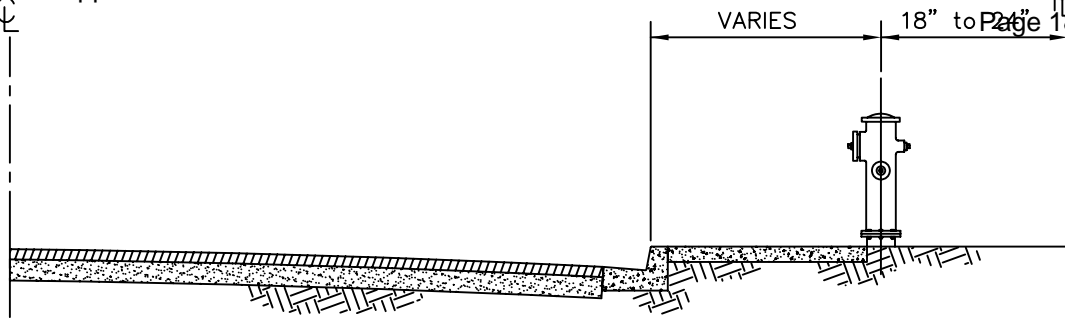
SECTION

NOTES:

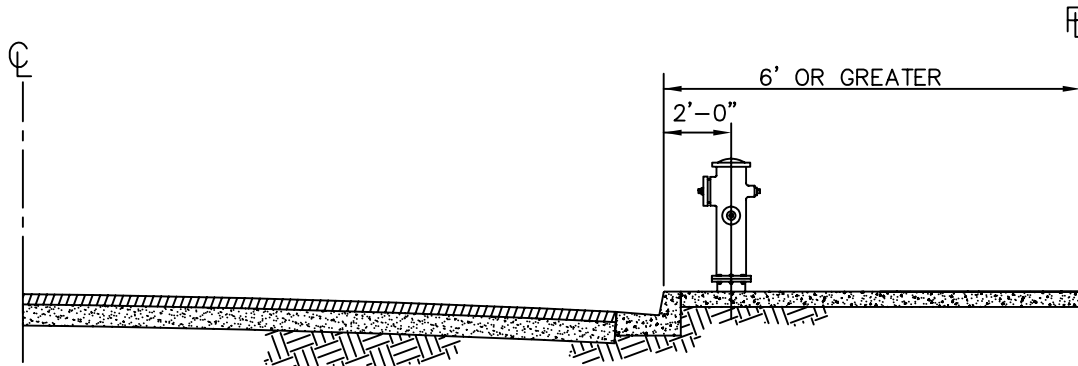
1. SEE PLANS FOR No. OF BARRICADES TO BE USED.
2. THE EXACT LOCATION OF BARRICADES MAY BE CHANGED BY THE ENGR.
3. THE STEEL PIPE ABOVE GROUND SHALL BE PAINTED WITH PRIMER COAT.
4. TWO FINISH COATS OF "SCHOOL BUS YELLOW" SHALL BE USED FOR BARRICADES.
5. BARRICADES FOR FLUSHOUTS, AIR RELEASE VALVES, & VAULT VENTS SHALL BE GIVEN TWO FINISH COATS OF METALLIC GREEN PAINT.
6. DO NOT LOCATE BOLLARD DIRECTLY ABOVE MAIN OR HYDRANT LATERAL.
7. INSURE SUFFICIENT CLEARANCE FOR HYDRANT WRENCH USE.
8. INSURE NO OBSTRUCTION TO ANY NOSSLE ON FIRE HYDRANT.

REVISIONS		AMERICAN WATER STANDARD CIVIL FIRE HYDRANT PROTECTION PIPE BOLLARD – DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
			
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 07-31-06 PROJECT IP	USE DIMENSIONS ONLY SCALE 3/4" = 1'-0"
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD34

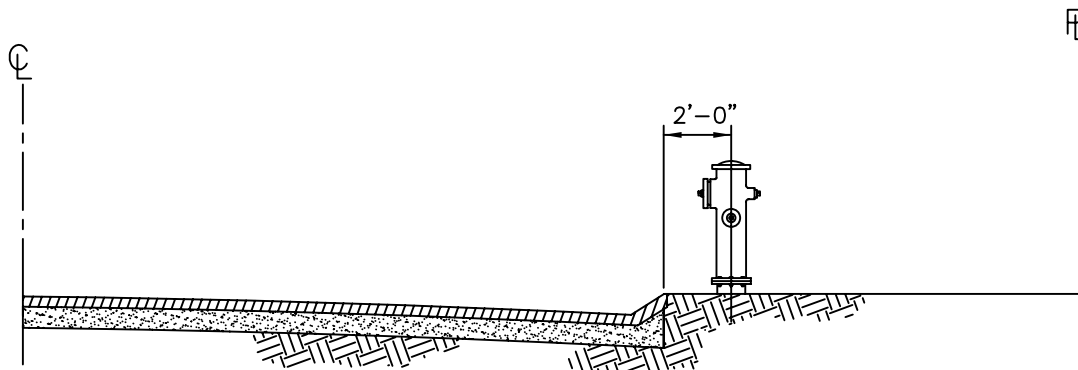




CASE 1 WHEN SIDEWALKS ARE ADJACENT TO CURB, HYDRANTS SHALL BE CENTERED AT BACK OF SIDEWALK.




CASE 2 WHEN SIDEWALKS ARE CONSTRUCTED WITH WIDTHS GREATER THAN 6' FROM CURB FACE TO OUTSIDE EDGE OF SIDEWALK HYDRANTS SHALL BE PLACED 24" FROM THE CURB FACE.



CASE 3 WHEN INVERTED SHOULDER SECTION IS PERMITTED AND CURB, GUTTER AND SIDEWALKS ARE WAIVED, THE HYDRANT SHALL BE CENTERED 24" BEHIND THE EDGE OF PAVEMENT.

#### NOTES:

1. REQUIREMENT OF LOCAL AUTHORITY HAVING JURISDICTION SHALL PREVAIL. IN THEIR ABSENCE, THE INSTALLATIONS SHOWN MAY BE USED.
2. EXACT HYDRANT LOCATION TO BE FIELD DETERMINED BY LOCAL AUTHORITY HAVING JURISDICTION.

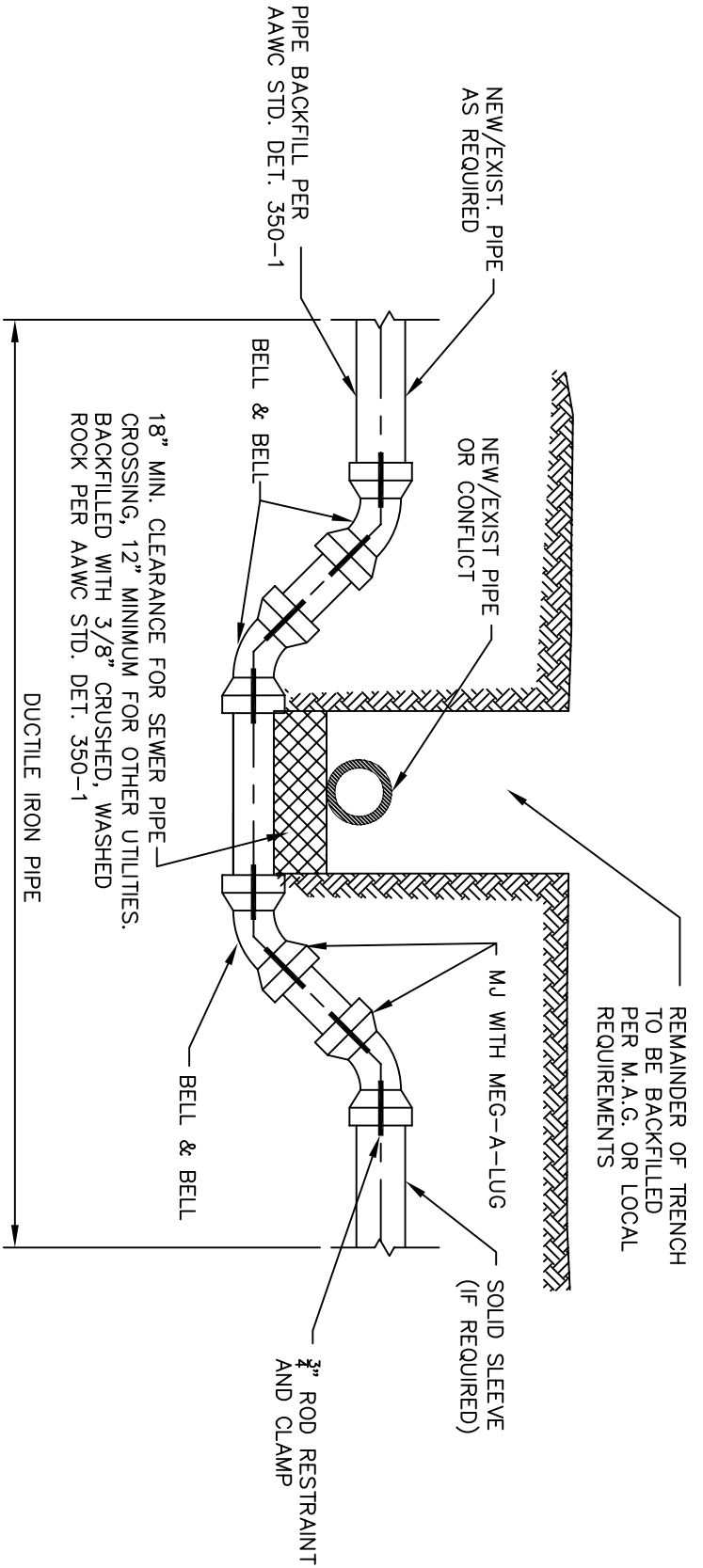
REVISIONS		AMERICAN WATER STANDARD CIVIL FIRE HYDRANT LOCATION DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
			
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 10-10-06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD36

Information Only - Subject to Revision

FINAL

0201-0601-SD36

0201-0601-SD36



NOTES:

1. ALL PIPE TO BE JOINT RESTRAINED.
2. PIPE IS TO BE DUCTILE IRON, MINIMUM PRESSURE CLASS 350.
3. ALL DUCTILE IRON PIPE SHALL BE POLYETHYLENE WRAPPED FOR THE ENTIRE LENGTH.
4. BEGIN/END RESTRAINED JOINT STATIONING TO BE SHOWN ON THE APPROVED CONSTRUCTION DRAWINGS. ALL BENDS & FITTINGS SHALL HAVE STATIONING AND ELEVATION SHOWN ON THE APPROVED CONSTRUCTION DRAWINGS. THE BOTTOM ELEVATION OF THE CONFLICT AND THE TOP ELEVATION OF THE DUCTILE IRON PIPE AT THE CENTERLINE OF THE CONFLICT SHALL BE SHOWN ON THE APPROVED CONSTRUCTION DRAWINGS.

REVISIONS  
7/07 - MSG EDITS

AMERICAN WATER STANDARD  
CIVIL  
VERTICAL REALIGNMENT OF WATER MAINS  
DETAIL

AMERICAN WATER  
VOORHEES, NJ 08043

AMERICAN WATER ENG. CENTER  
213 CARRIAGE LANE  
DELRAN, NJ 08075



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PROJECT ENG'R RESP. ENGINEER 10-10-06  
APPROVED PROJECT IP  
USE DIMENSIONS ONLY  
SCALE N.T.S.

USE APPROVED DRAWINGS ONLY  
FOR CONSTRUCTION PURPOSES

0201-0601-SD42

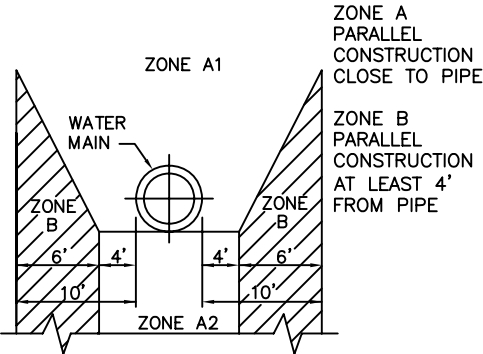
FINAL

0201-0601-SD42

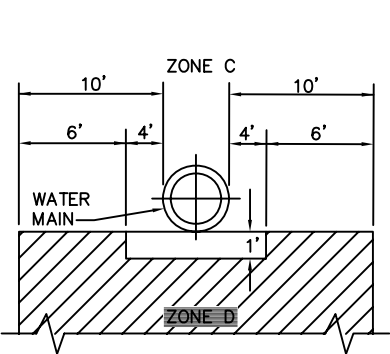
SPECIAL CONSTRUCTION REQUIREMENTS

WHERE REQUIRED WATER MAIN SEPARATION FROM SEWER CANNOT BE MAINTAINED

PARALLEL CONSTRUCTION



PERPENDICULAR CONSTRUCTION



ZONE C PERPENDICULAR ABOVE OR EVEN HORIZONTAL

ZONE D PERPENDICULAR BELOW HORIZONTAL IF AN EXISTING SEWER IS LOCATED WITHIN THESE LIMITS. THE CONDITIONS REQUIREMENTS MAY APPLY (CONFIRM WITH REGULATOR)

REQUIRED SEPARATION BETWEEN WATER MAINS AND SANITARY SEWERS

BASIC SEPARATION REQUIREMENTS:

WATER MAINS AND SEWERS SHOULD BE SEPARATED AS FAR AS IS REASONABLE IN BOTH THE HORIZONTAL AND VERTICAL DIRECTIONS WITH SEWERS LOWER THAN WATER MAINS.

PARALLEL CONSTRUCTION: THE HORIZONTAL DISTANCE BETWEEN PRESSURE WATER MAINS AND SEWERS SHALL BE AT LEAST 10 FEET

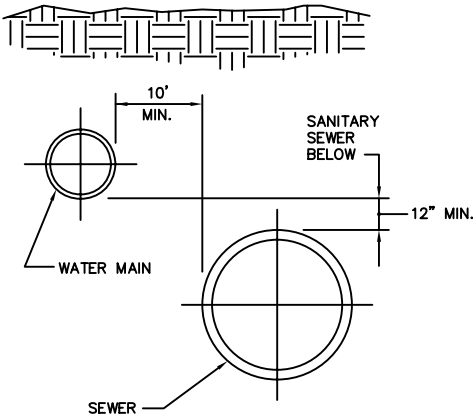
PERPENDICULAR CONSTRUCTION (CROSSING): PRESSURE WATER MAINS SHALL BE AT LEAST 18" ABOVE SANITARY SEWERS WHERE THESE LINES MUST CROSS.

IF AN EXISTING SEWER IS LOCATED WITHIN ZONES A1, A2, B, C, OR D OF A PROPOSED WATER MAIN, THE FOLLOWING SPECIAL REQUIREMENTS APPLY:

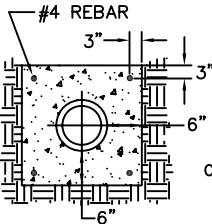
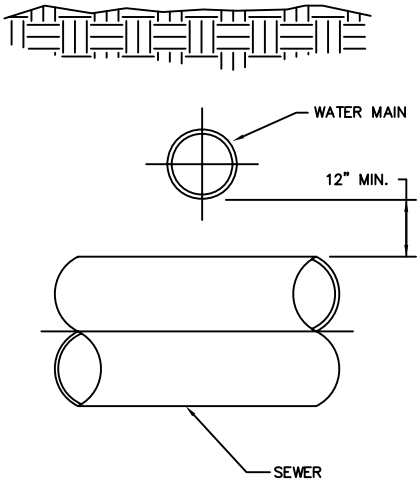
ZONE

- A. NO WATER MAINS SHALL BE CONSTRUCTED WITHOUT SPECIAL PERMISSION FROM THE APPROPRIATE HEALTH OR ENVIRONMENTAL REGULATOR.
- B. IF THE SEWER DOES NOT MEET ZONE B REQUIREMENTS, THE WATER MAIN SHALL BE OF PRESSURE CLASS 200 PIPE FOR PVC AND CLASS 350 FO D.I. PIPE. SEWER SHALL BE CONSTRUCTED EQUAL TO WATER PIPE AND TESTED FOR WATER TIGHTNESS.
- C. NO WATER MAINS SHALL BE CONSTRUCTED WITHOUT SPECIAL PERMISSION FROM THE HEALTH REGULATOR. IF PERMISSION IS GRANTED, THE SEWER PIPE SHALL BE ENCASED WITH REINFORCED CONCRETE AND THE WATER MAIN SHALL BE OF CLASS 200 PIPE OR EQUIVALENT.
- D. THE SEWER SHALL BE ENCASED WITH REINFORCED CONCRETE.

PARALLEL CONSTRUCTION



PERPENDICULAR CONSTRUCTION

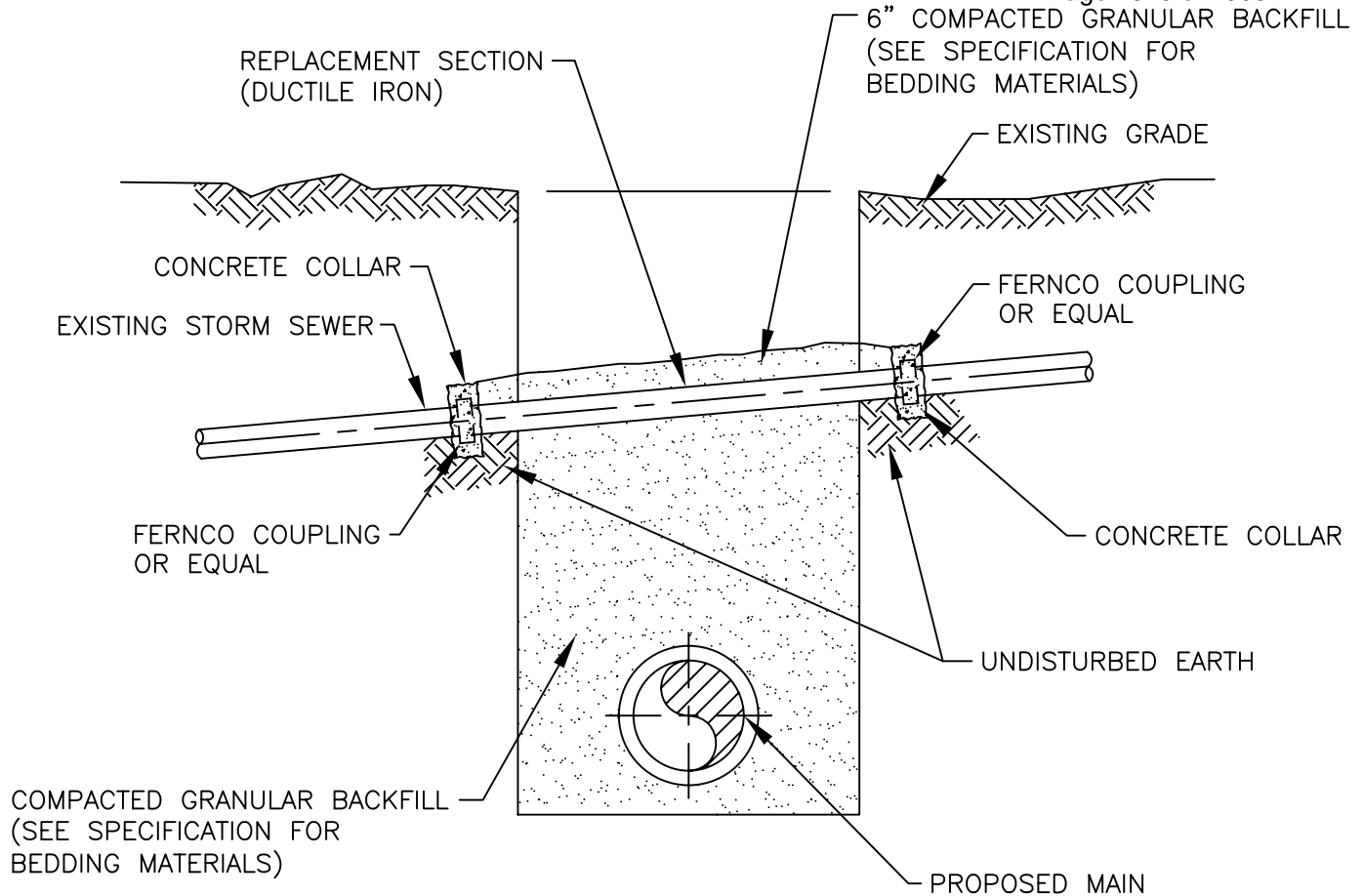


CONCRETE SHALL BE 3000 PSI CONCRETE

REVISIONS		AMERICAN WATER STANDARD	
7/07 - MSG EDITS		CIVIL	
		SPECIAL CONSTRUCTION REQUIREMENTS FOR	
		WATER MAIN - DETAIL	
		AMERICAN WATER	
		VOORHEES, NJ 08043	
		AMERICAN WATER ENL. CENTER	
		315 CARRIAGE LANE	
		BELLEVILLE, NJ 08007	
		DRAWN BY RJB	
		PROJECT ENG'D	
		DATE 10-10-06	
		PROJECT #	
		USE APPROVED DRAWINGS ONLY	
		FOR CONSTRUCTION PURPOSES	
		0201-0601-SD43	

FINAL

0201-0601-SD43



1. IF THE EXISTING STORM SEWER IS DAMAGED OR REMOVED DURING CONSTRUCTION IT SHALL BE REPLACED ACROSS THE TRENCH SUCH THAT THE CONCRETE COLLARS ARE SUPPORTED ON UNDISTURBED EARTH.

2. THE CONCRETE COLLAR SHALL BE FORMED AT A JOINT WITH THE EXISTING HOUSE LATERAL USING FERNCOM COUPLINGS.


3. THE REPLACEMENT SECTION SHALL BE CLASS 350 DUCTILE IRON PIPE WITH AND INSIDE DIAMETER EQUAL TO THE EXISTING PIPE. ANSI/AWWA C151/A21.51 DUCTILE IRON PIPE SHALL BE USED AS A MINIMUM STANDARD.

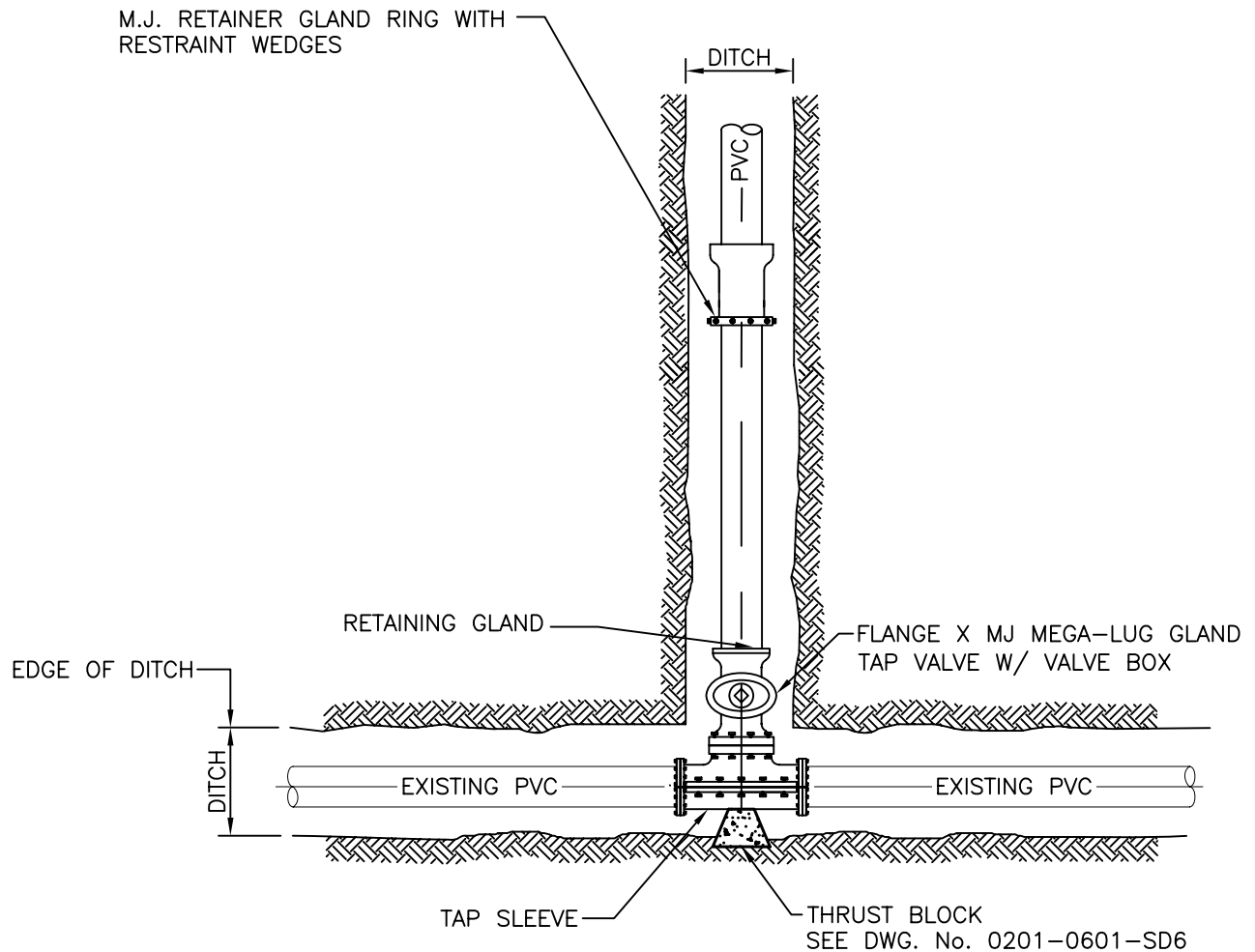
4. WHEN THE STORM SEWER OWNER HAS REQUIREMENTS WHICH ARE MORE STRINGENT, THE CONTRACTOR SHALL CONFORM TO THE MORE STRINGENT REQUIREMENTS AND MAKE NO CLAIM FOR ADDITIONAL COMPENSATION OR AN EXTENSION OF TIME BECAUSE OF SUCH REQUIREMENTS.

REVISIONS		AMERICAN WATER STANDARD CIVIL STORM SEWER REPLACEMENT DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER WORKS SERVICE COMPANY SYSTEM ENGINEERING	
		AMERICAN WATER WORKS SERVICE COMPANY, INC. SYSTEM ENGINEERING	
		1025 LAUREL OAK RD.	




1. REFER TO SECTION 02512 PAGE 7 OF SPECIFICATIONS.
2. REFER TO SPECIFICATION SECTION 0317, PAGE 11 AND SECTION 02320 FOR BEDDING REQUIREMENTS.
3. 18" I.D. CHAMBER FOR USE WITH 5/8" METER. 20" I.D. CHAMBER FOR USE WITH 1" METER. OTHER METER BOX ARRANGEMENTS AS APPROVED BY AW.
4. METER BOX LOCATION (IF APPLICABLE) TO BE DETERMINED BY AW.
5. POINT OF DEMARCATION FOR SERVICE LINE OWNERSHIP PER PRIME CONTRACT BETWEEN AW AND GOVERNMENT.
6. CONFIRM LOCATION OF CURB BOX WITH AW REPRESENTATIVE.
7. SERVICE LINE MATERIAL PER SECTION 02512 OF SPECIFICATIONS.

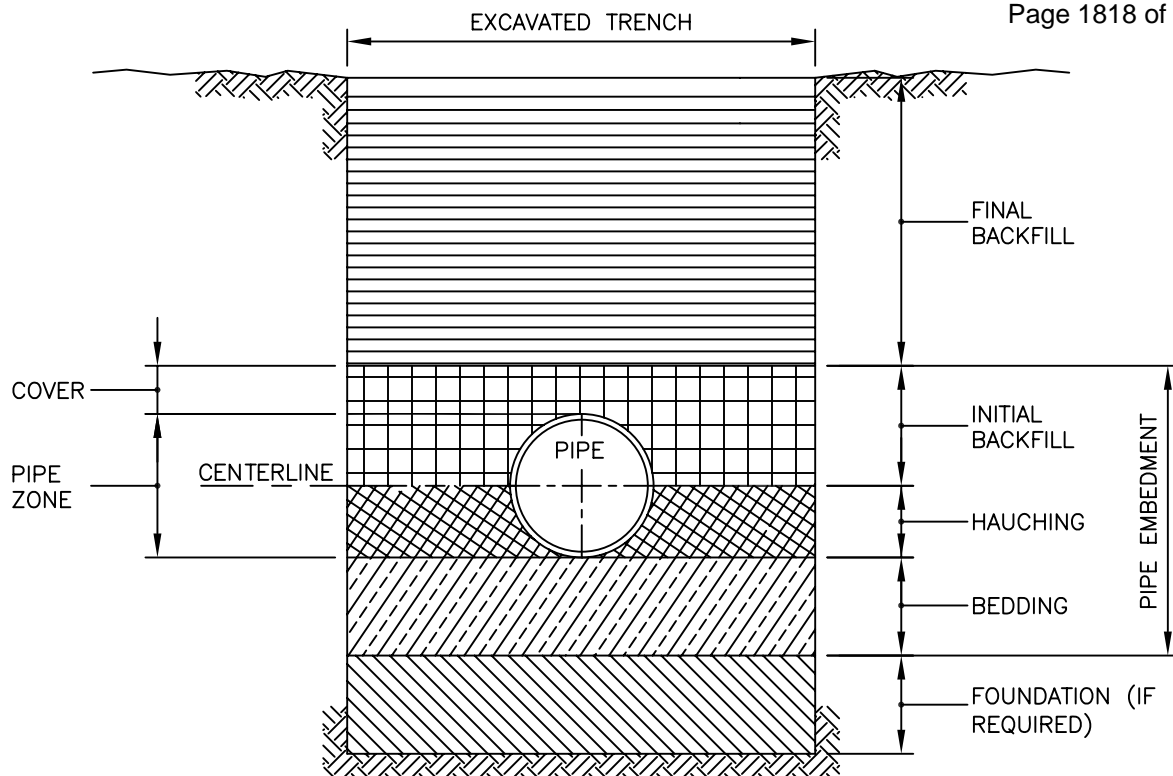
<div> <div>REVISIONS</div> <div>7/07 – MSG EDITS</div> </div>	<div>AMERICAN WATER STANDARD CIVIL 2" AND BELOW SERVICE LINE INSTALLATION – DETAIL</div>	
	<div>AMERICAN WATER VOORHEES, NJ 08043</div>	
	<div>AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075</div>	<div>  <div> <div>American</div> <div>Water®</div> </div> </div>
	<div> <div>DRAWN BY RJB PROJECT ENG'R APPROVED</div> <div> <div>DATE 08-01-03 PROJECT IP</div> <div>USE DIMENSIONS ONLY SCALE N.T.S.</div> </div> </div>	<div>USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES</div>
		<div>0201-0601-SD47</div>



## NOTES:

1. ONE RETAINER GLAND RINGS WITH RESTRAINT WEDGES SHALL BE INSTALLED ON OUTLET SIDE OF TAPPING VALVE.
2. RETAINER GLAND RINGS PER SPECIFICATION.
3. 4" MINIMUM BRANCH SIZE

REVISIONS		AMERICAN WATER STANDARD CIVIL PVC TAP DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
			
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 08-07-06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD49



### TRENCH TERMINOLOGY

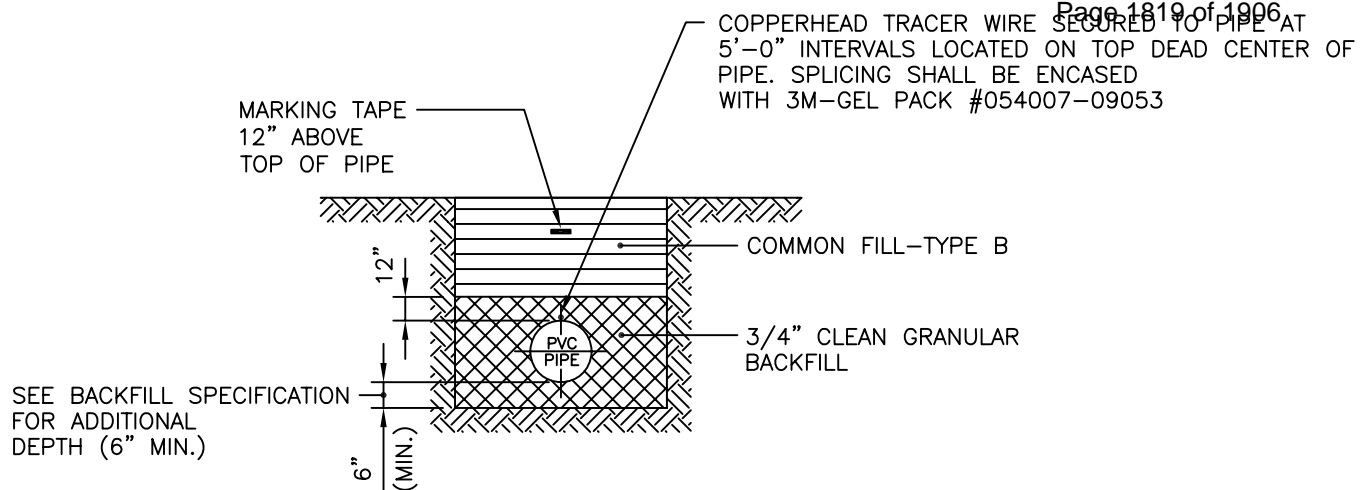
**FOUNDATION:** A FOUNDATION IS NECESSARY ONLY WHEN NATIVE SOILS ARE UNSTABLE. FOR SUCH CONDITIONS, THE TRENCH IS OVER-EXCAVATED AND A LAYER OF SUPPORTIVE MATERIAL IS PLACED AND COMPACTED TO PROVIDE A FIRM FOUNDATION FOR THE SUBSEQUENT PIPE EMBEDMENT MATERIALS.

**EMBEDMENT:** THIS ZONE IS THE MOST IMPORTANT IN TERMS OF PIPE PERFORMANCE. IT IS DIVIDED INTO THE FOLLOWING SUB ZONES:

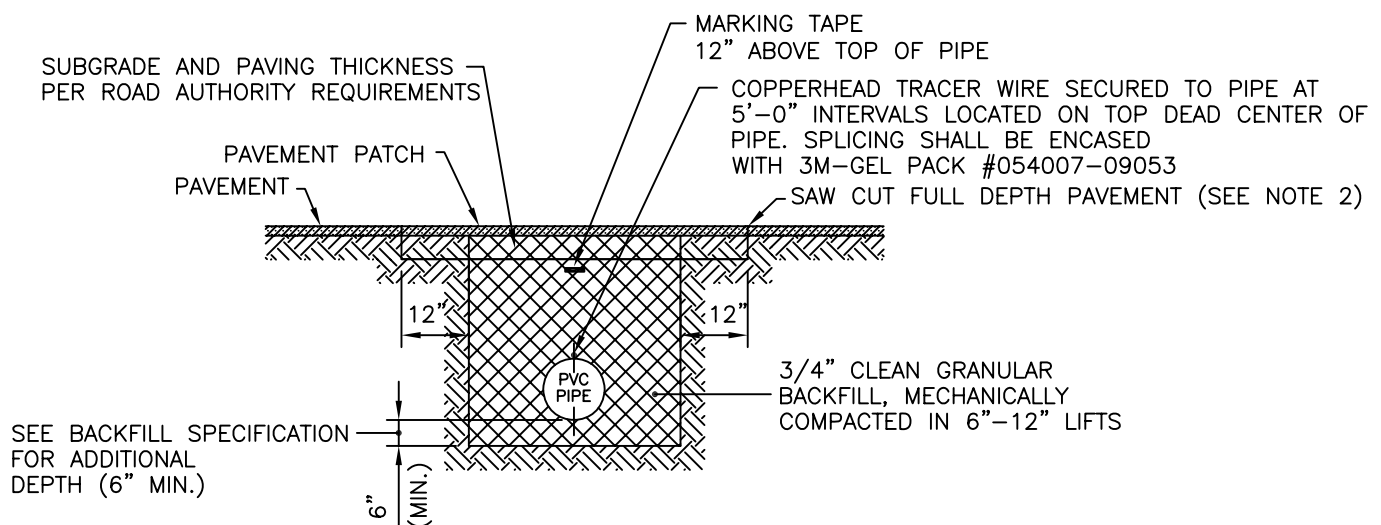
- **BEDDING:** TYPICALLY FOUR TO SIX INCHES OF SUPPORTIVE, COMPACTED MATERIAL. THIS ZONE PROVIDES EVEN SUPPORT FOR THE PIPE AND BRINGS IT TO GRADE.
- **HAUNCHING:** EXTENDS FROM THE BOTTOM OF THE PIPE TO THE CENTERLINE OF THE PIPE. IT PROVIDES THE MOST RESISTANCE TO PIPE DEFLECTION. SPECIFYING PROPER MATERIALS AND COMPACTION ARE MOST IMPORTANT FOR THIS ZONE.
- **INITIAL BACKFILL:** EXTENDS FROM THE SPRINGLINE TO A POINT ABOVE THE TOP OF THE PIPE. THIS ZONE PROVIDES SOME PIPE SUPPORT AND HELPS TO PREVENT DAMAGE TO THE PIPE DURING PLACEMENT OF THE FINAL BACKFILL. THE COVER EXTENDS FROM THE TOP OF THE PIPE TO THE TOP OF THE INITIAL BACKFILL. THE DEPTH OF COVER SHOULD BE AS MUCH AS NECESSARY TO PROTECT THE PIPE DURING PLACEMENT OF THE FINAL BACKFILL. TWELVE INCHES IS A COMMON DEPTH OF COVER.

**FINAL BACKFILL:** THIS ZONE EXTENDS FROM THE TOP OF THE INITIAL BACKFILL TO THE TOP OF THE TRENCH. THIS ZONE HAS LITTLE INFLUENCE ON PIPE PERFORMANCE, BUT CAN BE IMPORTANT TO THE INTEGRITY OF ROADS AND STRUCTURES.

REVISIONS		AMERICAN WATER STANDARD CIVIL PIPE TRENCH TERMINOLOGY DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 09-22-06 PROJECT IP	
		USE DIMENSIONS ONLY SCALE N.T.S.	
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES ,	0201-0601-SD53

**DETAIL "A"**

PVC - ROCK/SOIL  
(FOR AREAS NOT TO BE PAVED)


**DETAIL "B"**

PVC - ROCK/SOIL (FOR PAVED  
AREAS OR AREAS TO BE PAVED OR  
WITHIN 18" OF PAVING)

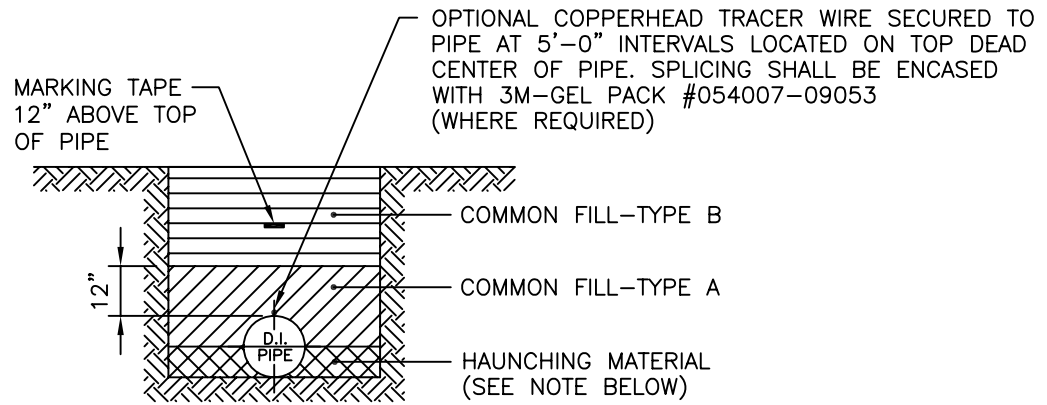
NOTE: SEE SPECIFICATION SECTIONS  
FOR DESCRIPTION OF BACKFILL AND BEDDING  
MATERIAL.

## NOTES:

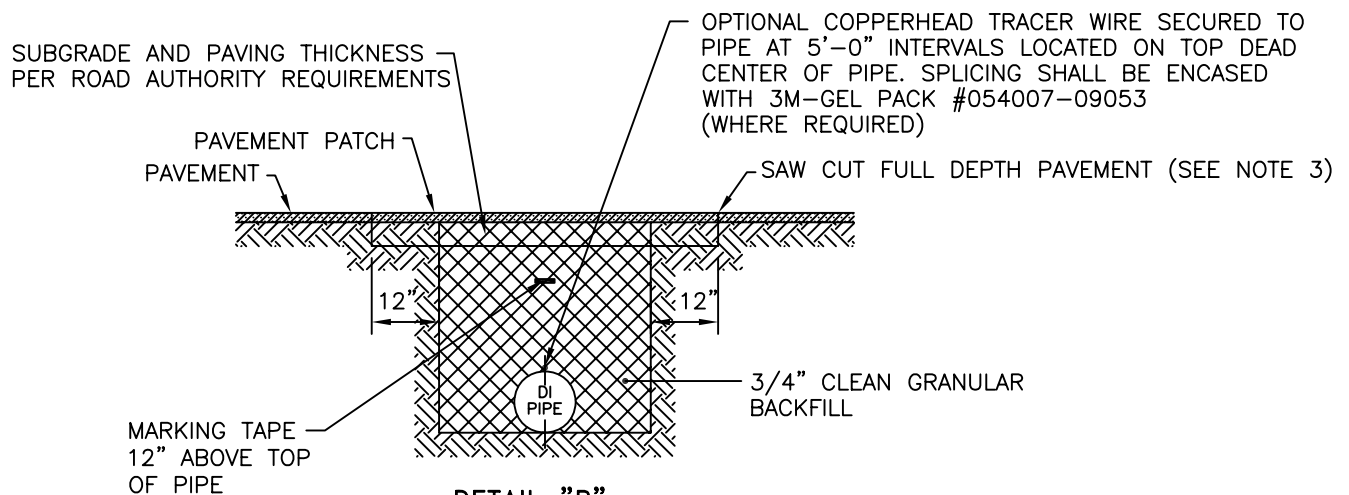
1. CAUTION MUST BE EXERCISED TO ENSURE PROPER PLACEMENT OF EMBEDMENT MATERIAL UNDER THE HAUNCHES OF THE PIPE.
2. IF EDGE OF SAW CUT IS  $\leq$  4LF FROM CURB LINE, REMOVE PAVEMENT TO CURB

REVISIONS		AMERICAN WATER STANDARD CIVIL TRENCH – PVC PIPE IN ROCK/SOIL DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
			
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 07–31–06 PROJECT IP	
		USE DIMENSIONS ONLY SCALE N.T.S.	
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	
		0201–0601–SD54	



**DETAIL "A"**

D.I. - SOIL  
(FOR AREAS NOT TO BE PAVED)

**DETAIL "B"**

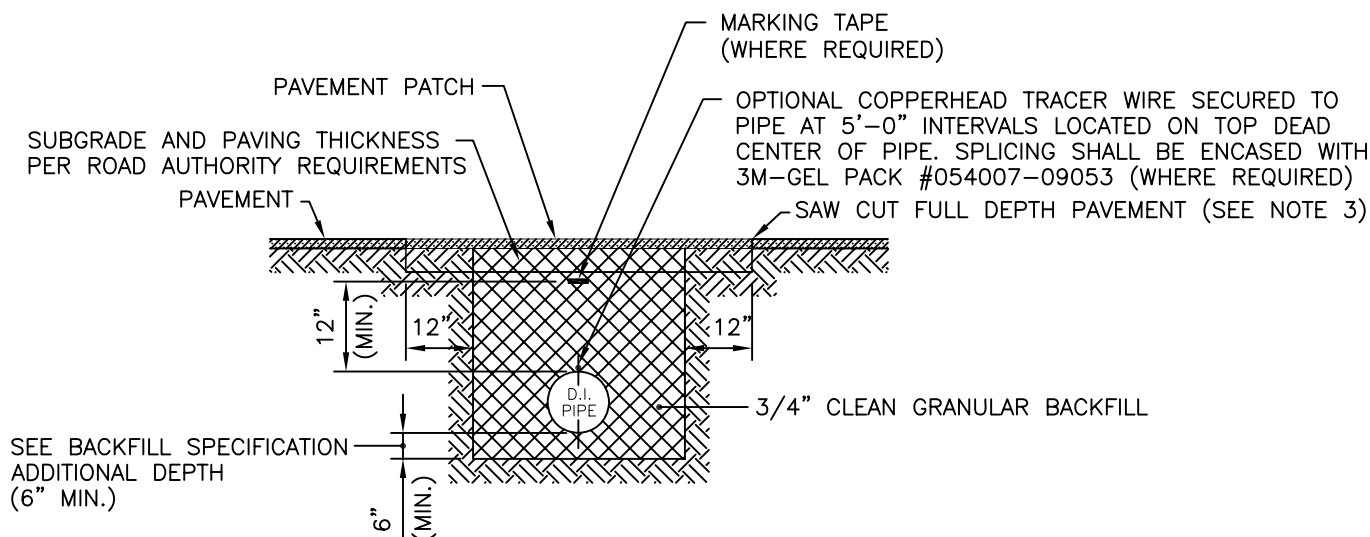
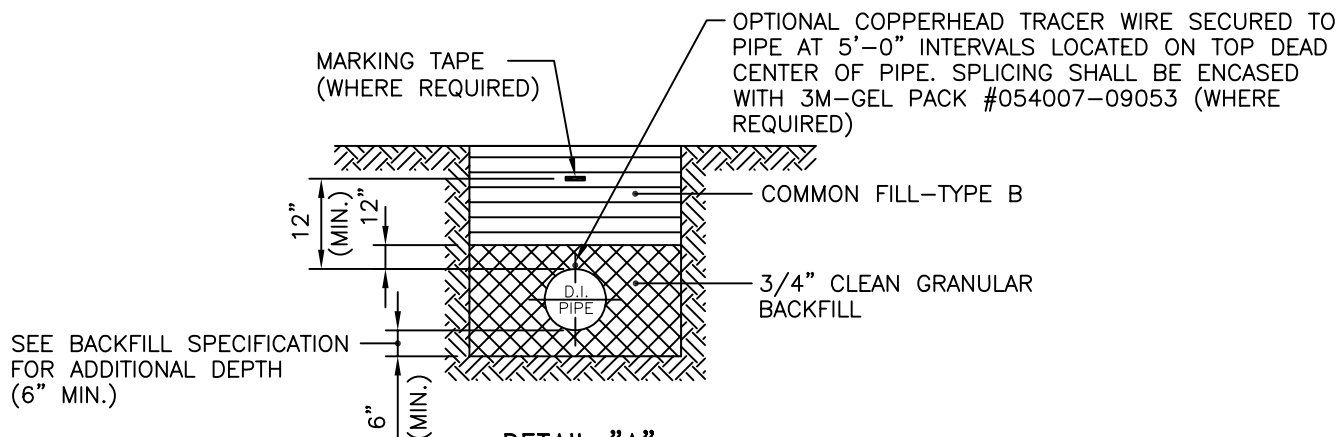
D.I. - SOIL  
(FOR PAVED AREAS OR AREAS TO  
BE PAVED OR WITHIN 18" OF  
PAVING)

NOTE: SEE SPECIFICATION SECTIONS  
FOR DESCRIPTION OF BACKFILL AND BEDDING  
MATERIAL.

**NOTES:**

1. CAUTION MUST BE EXERCISED TO ENSURE PROPER PLACEMENT OF EMBEDMENT MATERIAL UNDER THE HAUNCHES OF THE PIPE.
2. POLYETHYLENE ENCASING ON ALL D.I. PIPE, FITTINGS, VALVES & APPURTENANCES
3. IF EDGE OF SAW CUT IS  $\leq$  4LF FROM CURB LINE, REMOVE PAVEMENT TO CURB


REVISIONS		AMERICAN WATER STANDARD CIVIL TRENCH – D.I. PIPE IN SOIL DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 07–31–06 PROJECT IP	
		USE DIMENSIONS ONLY SCALE N.T.S.	
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	
		0201–0601–SD55	

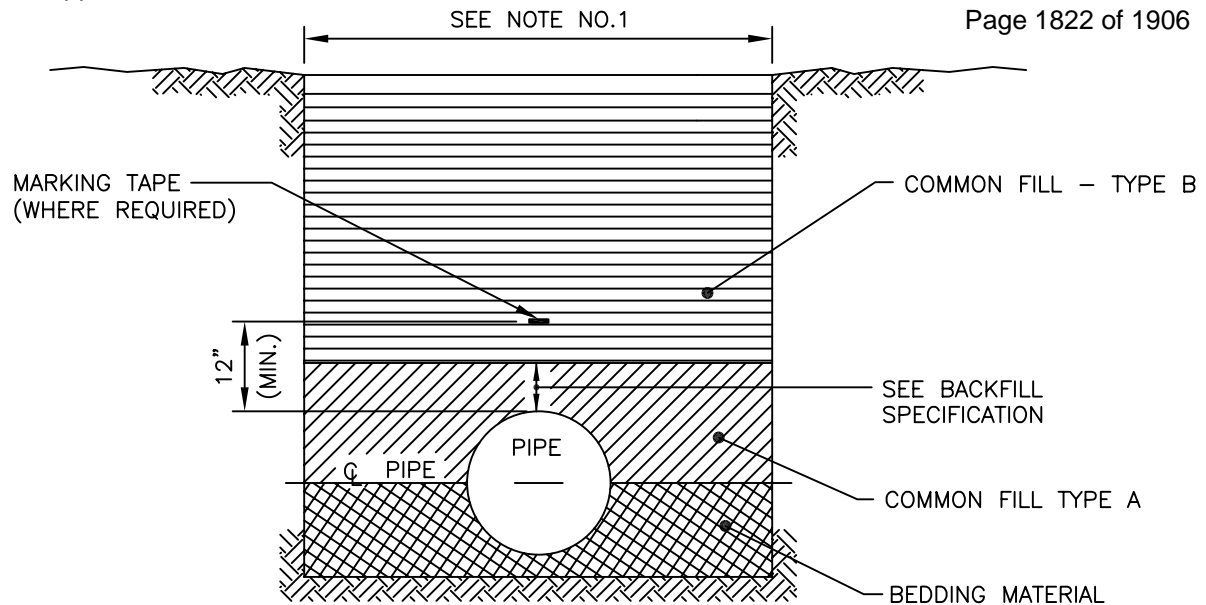
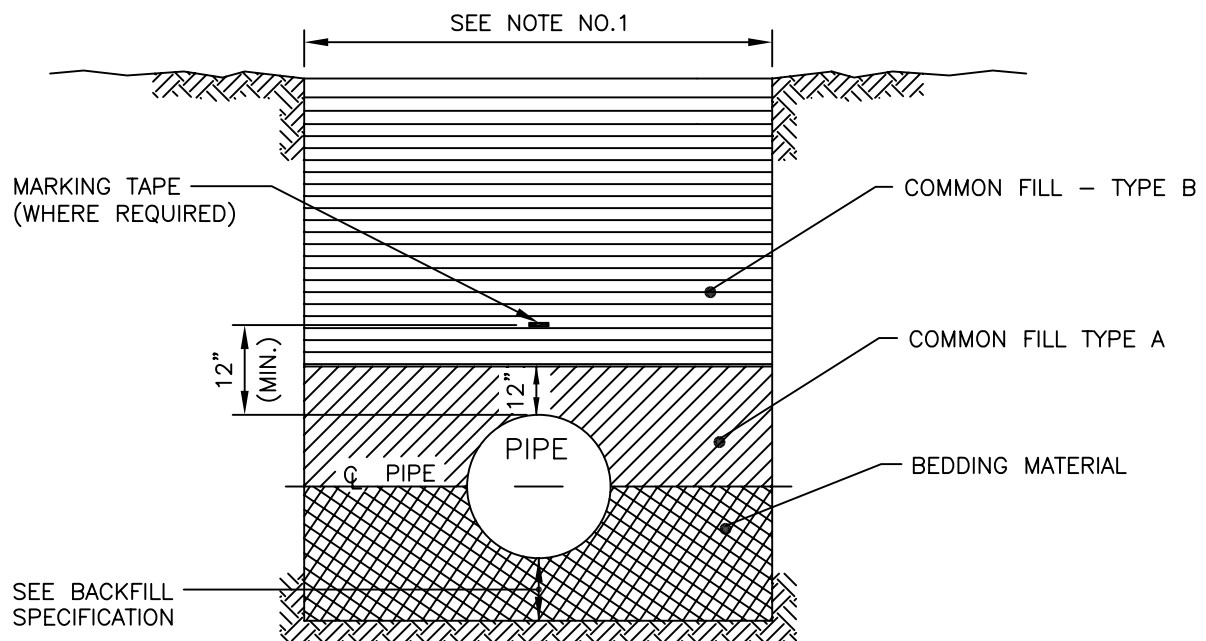


NOTE: SEE SPECIFICATION SECTIONS FOR DESCRIPTION OF BACKFILL AND BEDDING MATERIAL.

## NOTES:

1. CAUTION MUST BE EXERCISED TO ENSURE PROPER PLACEMENT OF EMBEDMENT MATERIAL UNDER THE HAUNCHES OF THE PIPE.
2. POLYETHYLENE ENCASING ON ALL D.I. PIPE, FITTINGS, VALVES & APPURTENANCES
3. IF EDGE OF SAW CUT IS  $\leq$  4LF FROM CURB LINE, REMOVE PAVEMENT TO CURB


REVISIONS		AMERICAN WATER STANDARD CIVIL TRENCH – D.I. PIPE IN ROCK DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
		 American Water®	
		DRAWN BY RJB PROJECT ENGR APPROVED	
		DATE 07-31-06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD56

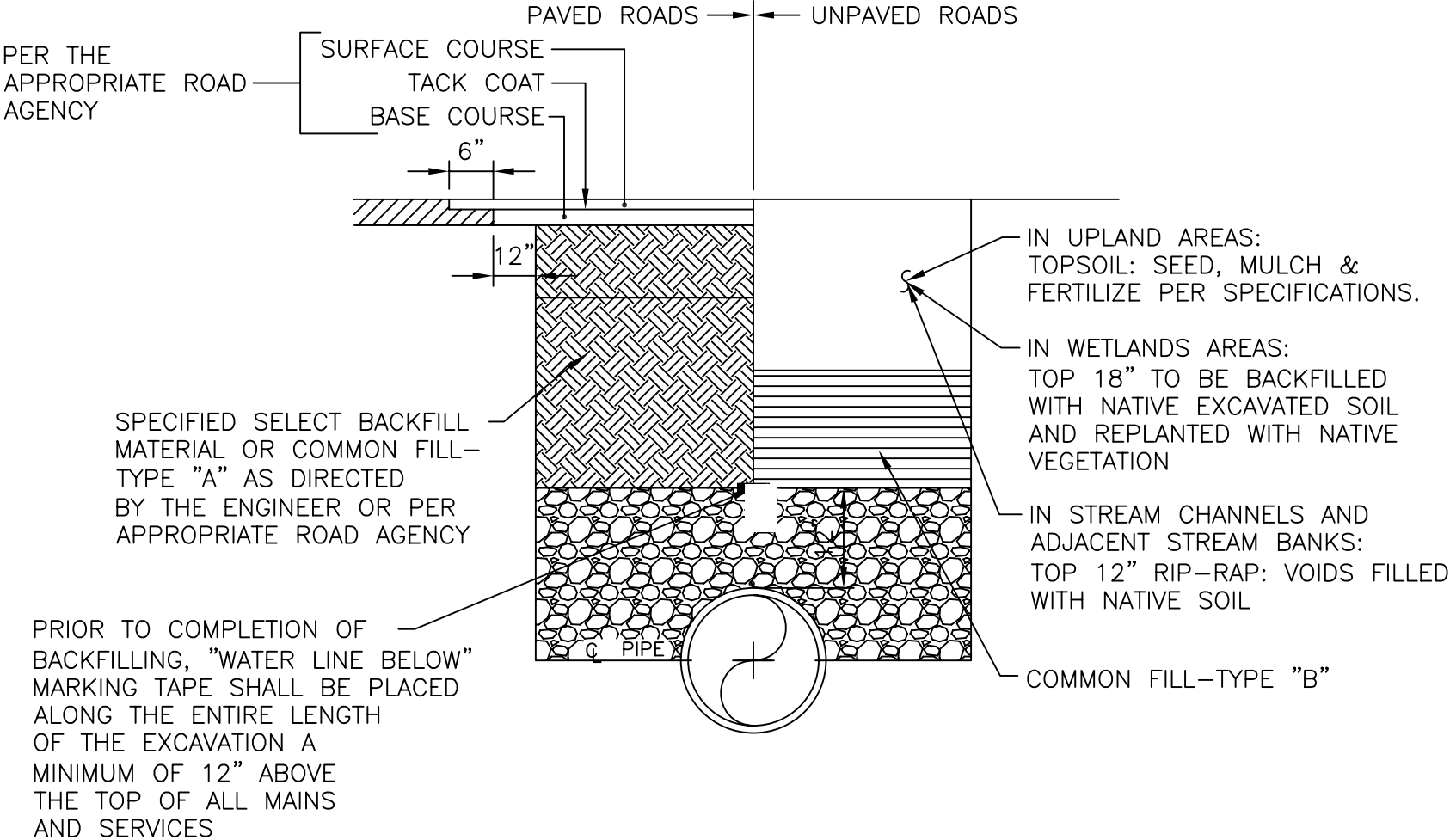
SOILROCK

## NOTE 1:


- IN UPLAND AREAS USE 4" TOPSOIL, SEED, MULCH & FERTILIZE PER SPECIFICATIONS.
- IN WETLAND AREAS, TOP 18" TO BE BACKFILLED WITH NATIVE EXCAVATED SOIL AND REPLANTED WITH NATIVE VEGETATION.
- IN STREAM CHANNELS AND ADJACENT STREAM BANKS, TOP 12" RIP-RAP, VOIDS FILL WITH NATIVE SOIL

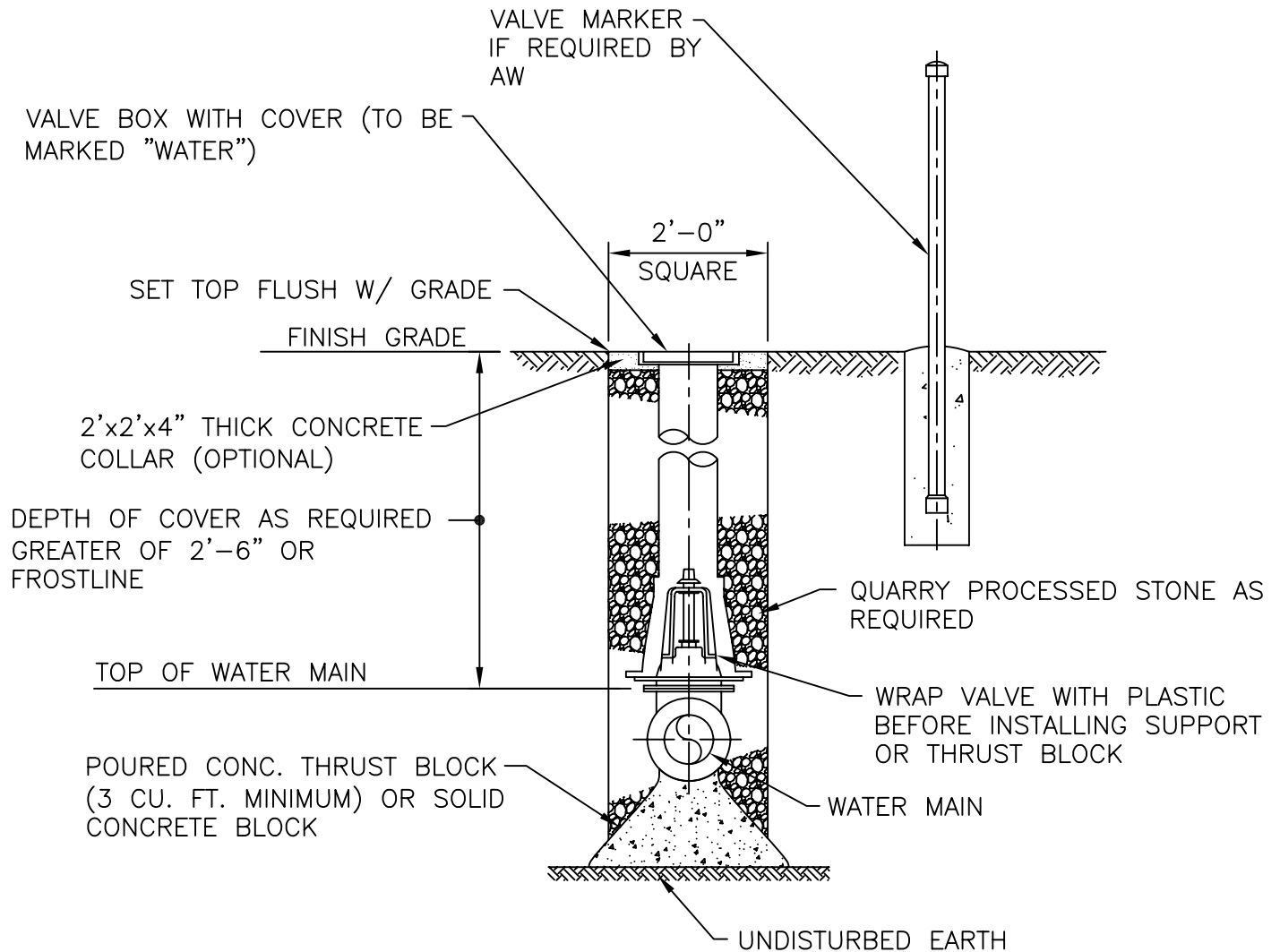
NOTE:  
SEE SPECIFICATION SECTIONS  
FOR DESCRIPTION OF BACKFILL  
MATERIAL

REVISIONS		AMERICAN WATER STANDARD CIVIL TRENCH BACKFILL MATERIALS UNPAVED AREAS – DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
			
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 07-31-06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES ,	0201-0601-SD57




0201-0601-SD58

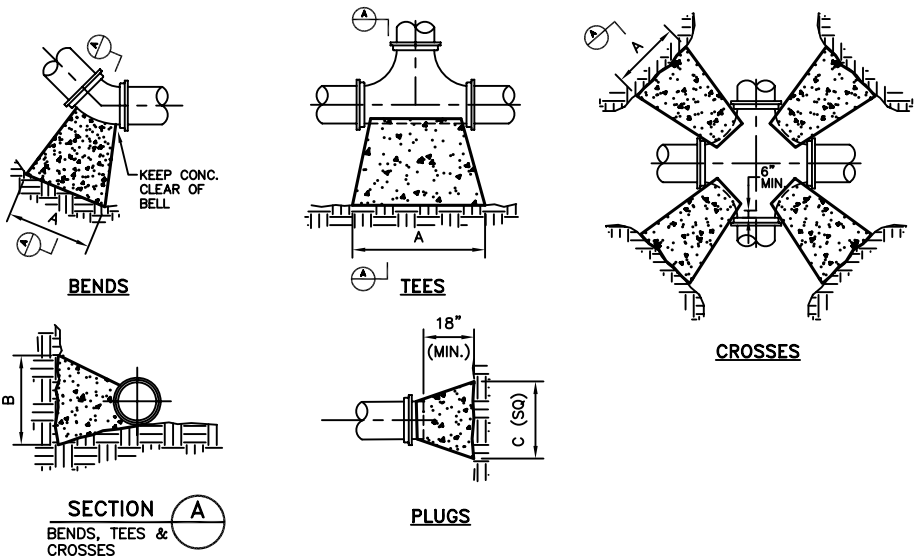
REVISIONS		AMERICAN WATER STANDARD CIVIL TRENCH RESTORATION DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		American Water Eng. Center 213 Carriage Lane Delran, NJ 08075	
		 American Water®	
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 7-31-06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD58



## NOTES:

1. IF PAD IS NOT TO BE  
POURED IMMEDIATELY AFTER  
VALVE BOX INSTALLATION,  
HOLE SHOULD BE  
BACKFILLED TO GRADE WITH  
QUARRY PROCESS STONE
2. INSURE OPERATING NUT IS  
CENTERED IN BOX DURING  
BACKFILL AND AFTER  
COMPACTION

REVISIONS		AMERICAN WATER STANDARD CIVIL VALVE BOX INSTALLATION DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
			
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 07–31–06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201–0601–SD59



- NOTES:**
- COVER OVER TOP OF PIPE SHALL BE BELOW FROST LINE OR 30" MINIMUM, 72" MAXIMUM ACCORDING TO REGULATORY REQUIREMENTS. IF GRADING PLANS RECEIVED BY THE ENGINEER/OWNER WITH THE REQUEST FOR WATER MAIN LAYOUT, INDICATE ADJUSTMENTS TO EXISTING GRADE, THEN PIPE SHALL BE INSTALLED TO MEET MINIMUM AND MAXIMUM COVER FROM PROPOSED GRADES SHOWN ON SAID PLANS.
  - THRUST BLOCKS SHALL BE BUILT AGAINST UNDISTURBED SOIL WITH ADEQUATE BACKING TO PREVENT MOVEMENT OF FITTING.
  - NO THRUST BLOCKS TO BE PLACED IN SEWER LATERAL DITCHES.
  - THRUST BLOCKING MUST FIT IN EASEMENT, IN SOME CASES ADDITIONAL RESTRAINT MAY BE REQUIRED.
  - BASED IN 150 PSI STATIC PRESSURE PLUS 50 PSI WATER HAMMER AND 2000 PSF SOIL BEARING.
  - POLYETHYLENE ENCASEMENT ON ALL D.I. PIPE AND FITTINGS.
  - PIPE JOINTS AND BOLTS MUST BE ACCESSIBLE.
  - ALLOW SUFFICIENT CLEARANCE BETWEEN CONCRETE AND BOLTS FOR FUTURE MAINTENANCE.
  - ALL ANCHOR BOLTS SHALL BE GALVANIZED STEEL, MINIMUM 1/2" DIAMETER. COAT EXPOSED ROD WITH ASPHALT CEMENT AFTER CONCRETE HAS SET.
  - ALL M.J. AND FLG. FITTINGS TO RECEIVE THRUST BLOCKS SHALL HAVE THE FASTENER AREAS FELT WRAPPED AND TAPED PRIOR TO THE CONCRETE POUR TO ALLOW FUTURE ACCESS TO THE FASTENERS AT THE JOINTS.
  - THRUST BLOCKING DETAILS ARE SHOWN HERE FOR TYPICAL INSTALLATIONS. IN SOME CASES, ADDITIONAL RESTRAINT MAY BE REQUIRED.
  - PORTLAND CEMENT CONCRETE USED FOR THRUST BLOCKS SHALL BE MIN 3000 PSI CONCRETE.
  - FOR UNSTABLE SOIL CONDITIONS, CHECK WITH ENGINEER FOR THRUST BLOCK DIMENSIONS.
  - FOR MAIN SIZES GREATER THAN 16", SEE ENGINEER FOR THRUST BLOCK DIMENSIONS.

REQUIRED BEARING AREA ON UNDISTURBED SOIL AND TYPICAL DIMENSIONS															
SIZE	CROSSES/90° BENDS			45° BENDS			11-1/4° BENDS			22-1/2° BENDS			TEES & PLUGS		
	AREA SQ. FT.	"A"	"B"	AREA SQ. FT.	"A"	"B"	AREA SQ. FT.	"A"	"B"	AREA SQ. FT.	"A"	"B"	AREA SQ. FT.	"A"	"B"
6"	4.0	32"	18"	2.2	18"	16"	0.6	5"	18"	1.1	9"	18"	2.8	23"	18"
8"	7.0	42"	24"	3.8	23"	24"	1.0	6"	24"	2.0	12"	24"	5.0	30"	24"
10"	11.0	53"	30"	6.3	30"	30"	1.6	8"	30"	3.1	15"	30"	8.0	38"	30"
12"	16.1	64"	36"	10.0	40"	36"	2.2	9"	36"	4.4	18"	36"	11.3	45"	36"
14"	21.6	74"	42"	12.5	43"	42"	3.0	10"	42"	6.0	21"	42"	15.5	53"	42"
16"	28.3	85"	48"	17.7	53"	48"	4.0	12"	48"	7.7	23"	48"	20.1	60"	48"

\* SURFACE AREA OF BEARING SOIL PROVIDED IS FOR 200 PSI MAXIMUM (INCLUDING SURGE) AND 2000 PSF SOIL BEARING. IF PRESSURE IS HIGHER OR SOIL POTENTIALLY LOWER, CONSULT ENGINEER FOR ADJUSTMENTS.

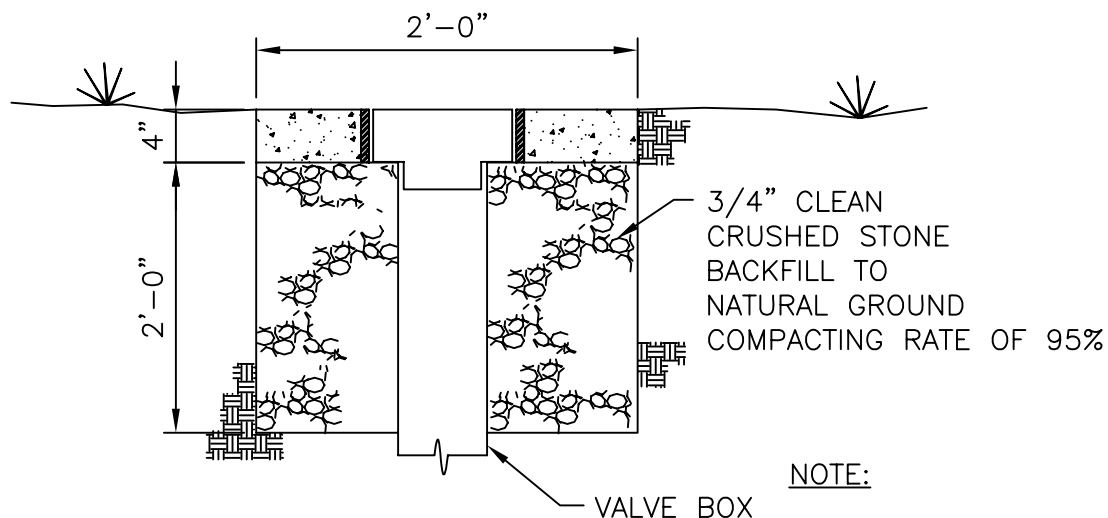
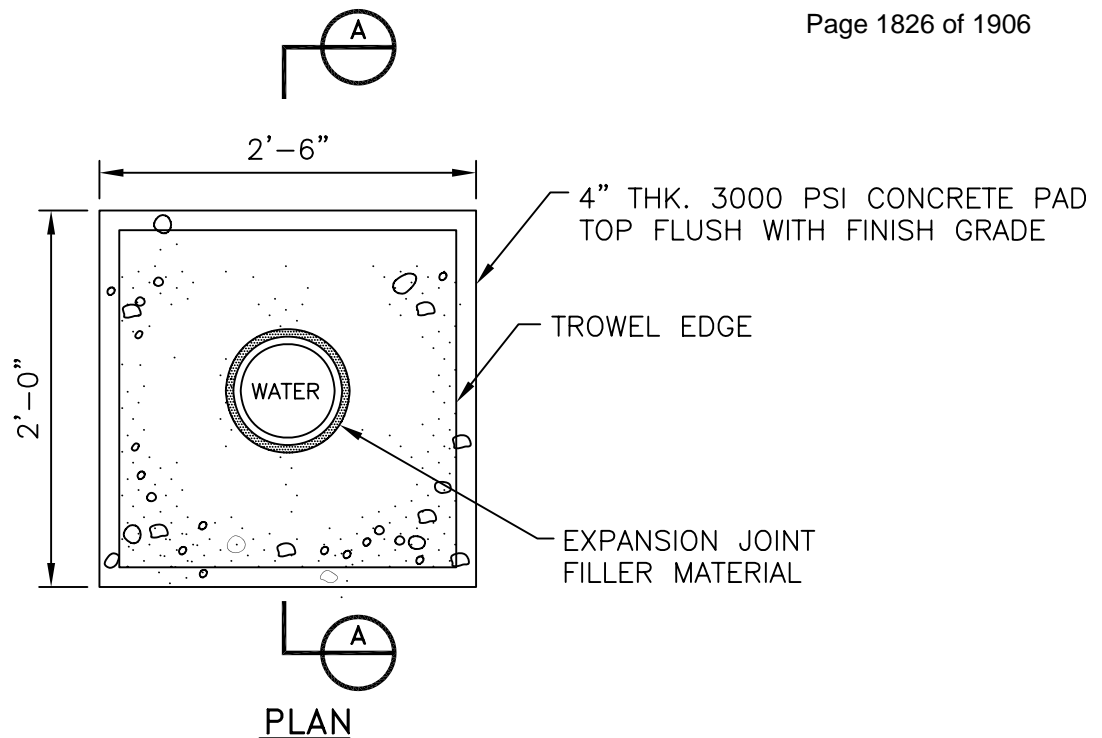
REVISIONS  
7/07 - MSG EDITS

AMERICAN WATER STANDARD  
CIVIL  
THRUST BLOCK  
DETAILS  
AMERICAN WATER  
VOORHEES, NJ 08043  
AMERICAN WATER ENG. CENTER  
215 CARRIDGE LANE  
DELRAN, NJ 08075  
DRAWN BY JLB  
PROJECT ENGR  
APPROVED  
DATE 10-18-08  
PROJECT #  
USE APPROVED DRAWINGS ONLY  
FOR CONSTRUCTION PURPOSES

0201-0601-SD6

FINAL

0201-0601-SD6

SECTION A-AVALVE BOX DETAIL  
IN UNPAVED AREAS

N.T.S.

NOTE:

IF PAD IS NOT TO BE POURED  
IMMEDIATELY AFTER VALVE BOX  
INSTALLATION, HOLE SHOULD BE  
BACKFILLED TO GRADE WITH  
3/4" CLEAN CRUSHED STONE  
BACKFILL

## REVISIONS

7/07 - MSG EDITS

AMERICAN WATER STANDARD  
CIVIL  
CONCRETE VALVE BOX PAD  
DETAIL

AMERICAN WATER  
VOORHEES, NJ 08043

AMERICAN WATER ENG. CENTER  
213 CARRIAGE LANE  
DELRAN, NJ 08075



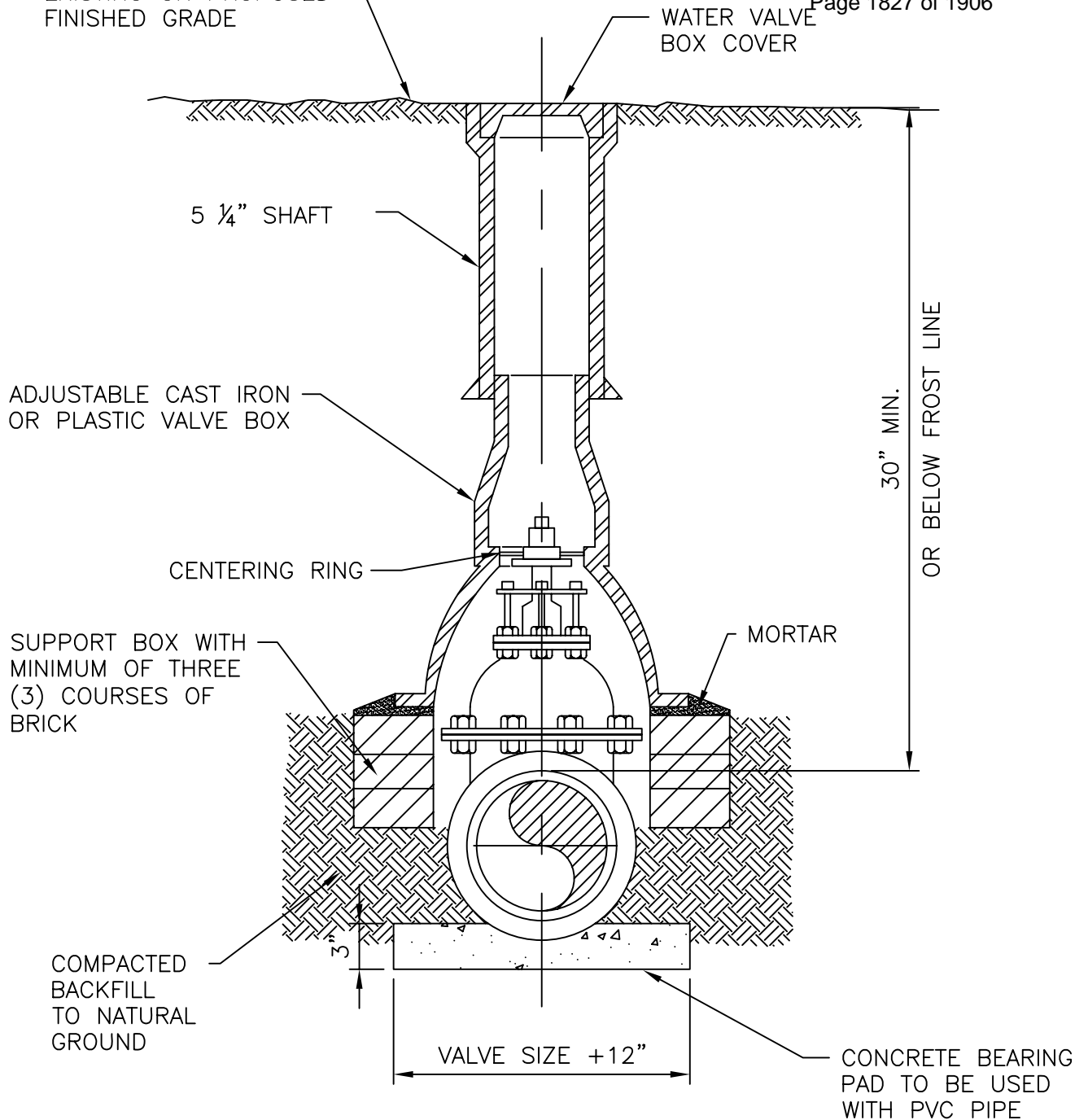
DRAWN BY RJB  
PROJECT ENG'R  
APPROVED

DATE 07-31-06  
PROJECT IP

USE DIMENSIONS ONLY  
SCALE N.T.S.

USE APPROVED DRAWINGS ONLY  
FOR CONSTRUCTION PURPOSES

0201-0601-SD60



## REVISIONS

7/07 - MSG EDITS

AMERICAN WATER STANDARD  
CIVIL  
OPTIONAL VALVE BOX INSTALLATION  
DETAILAMERICAN WATER  
VOORHEES, NJ 08043AMERICAN WATER ENG. CENTER  
213 CARRIAGE LANE  
DELRAN, NJ 08075DRAWN BY RJB  
PROJECT ENG'R  
APPROVEDDATE 07-31-06  
PROJECT IPUSE DIMENSIONS ONLY  
SCALE N.T.S.USE APPROVED DRAWINGS ONLY  
FOR CONSTRUCTION PURPOSES

0201-0601-SD61



LOCKING C.I. MANHOLE FRAME AND COVER IN ACCORDANCE WITH SPECIFICATIONS

WROUGHT IRON BLOW-OFF PIPE WITH MUSHROOM CAP AND BRONZE INSECT SCREEN. (BLOW-OFF PIPE TO BE SAME DIAMETER AS VALVE DISCHARGE ORIFICE)

OPTIONAL MARKER POST

GRADE

4" L ANCHORED TO WALL WITH PLATE AND WEDGE ANCHORS AND U-BOLT VALVE SUPPORT (COAT ALL PARTS WITH COAL TAR EPOXY)

DOUBLE CHK BFP

2" AIR/VACUUM RELEASE VALVE

U-BOLT

CONCRETE VALVE VAULT OF MANHOLE IN ACCORDANCE WITH SPECIFICATIONS

1/2 TON GRAVEL FOR DRAINAGE

2" COPPER TUBING TYPE "K"

2" CORPORATION STOP

BRICK (TYP.)

D.I. WATER MAIN

#### NOTES:

1. THIS TAPPING DETAIL IS FOR D.I. PIPE ONLY. FOR ALL OTHER MATERIALS, SEE TAPPING DETAIL SHEET.

#### REVISIONS

7/07 - MSG EDITS

AMERICAN WATER STANDARD  
CIVIL  
SHALLOW BURY AIR RELEASE VALVE  
ASSEMBLY DETAIL

AMERICAN WATER  
VOORHEES, NJ 08043

AMERICAN WATER ENG. CENTER  
213 CARRIAGE LANE  
DELRAN, NJ 08075



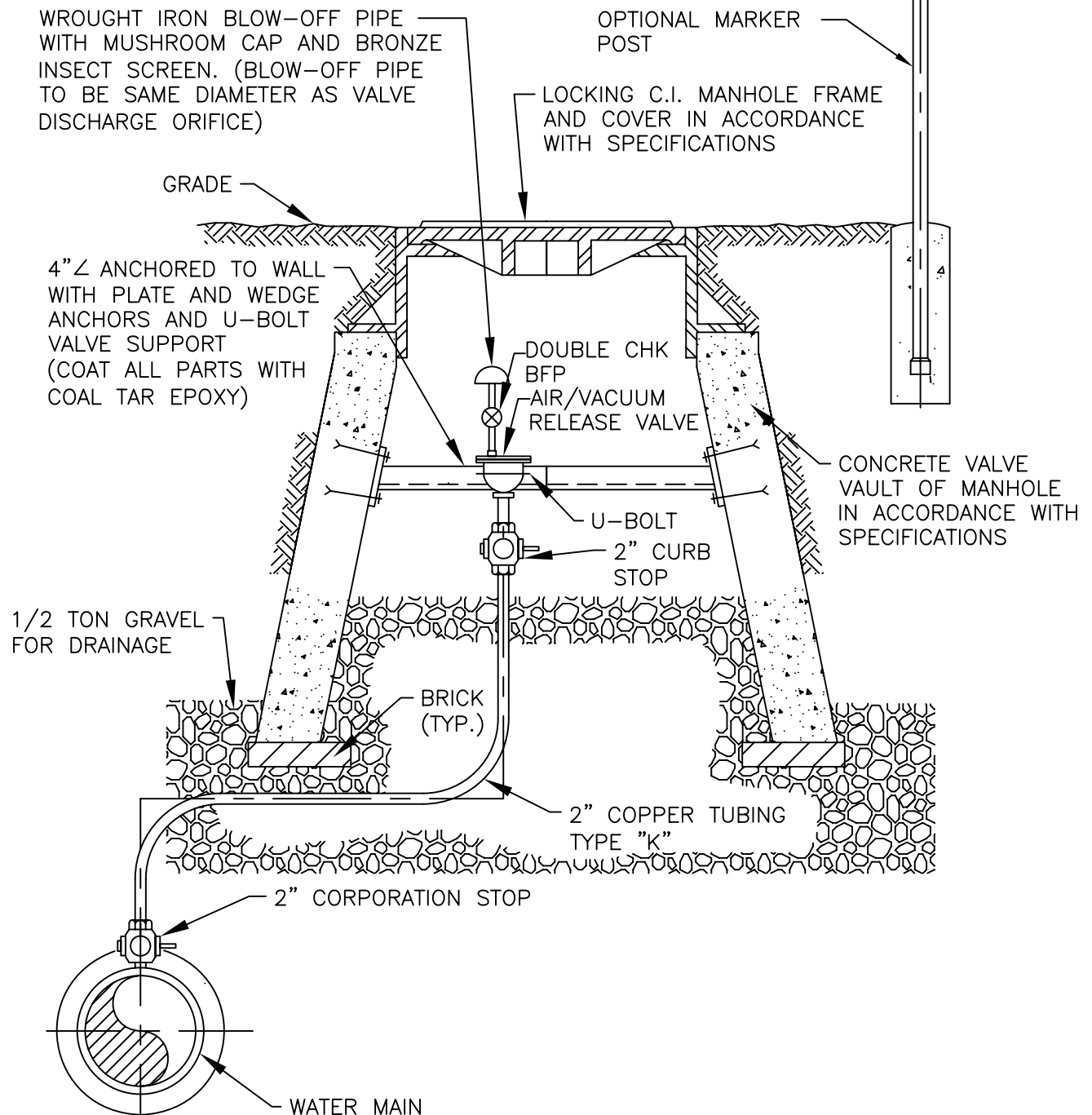
DRAWN BY RJB  
PROJECT ENG'R  
APPROVED

DATE 07-31-06  
PROJECT IP

USE DIMENSIONS ONLY  
SCALE N.T.S.


USE APPROVED DRAWINGS ONLY  
FOR CONSTRUCTION PURPOSES

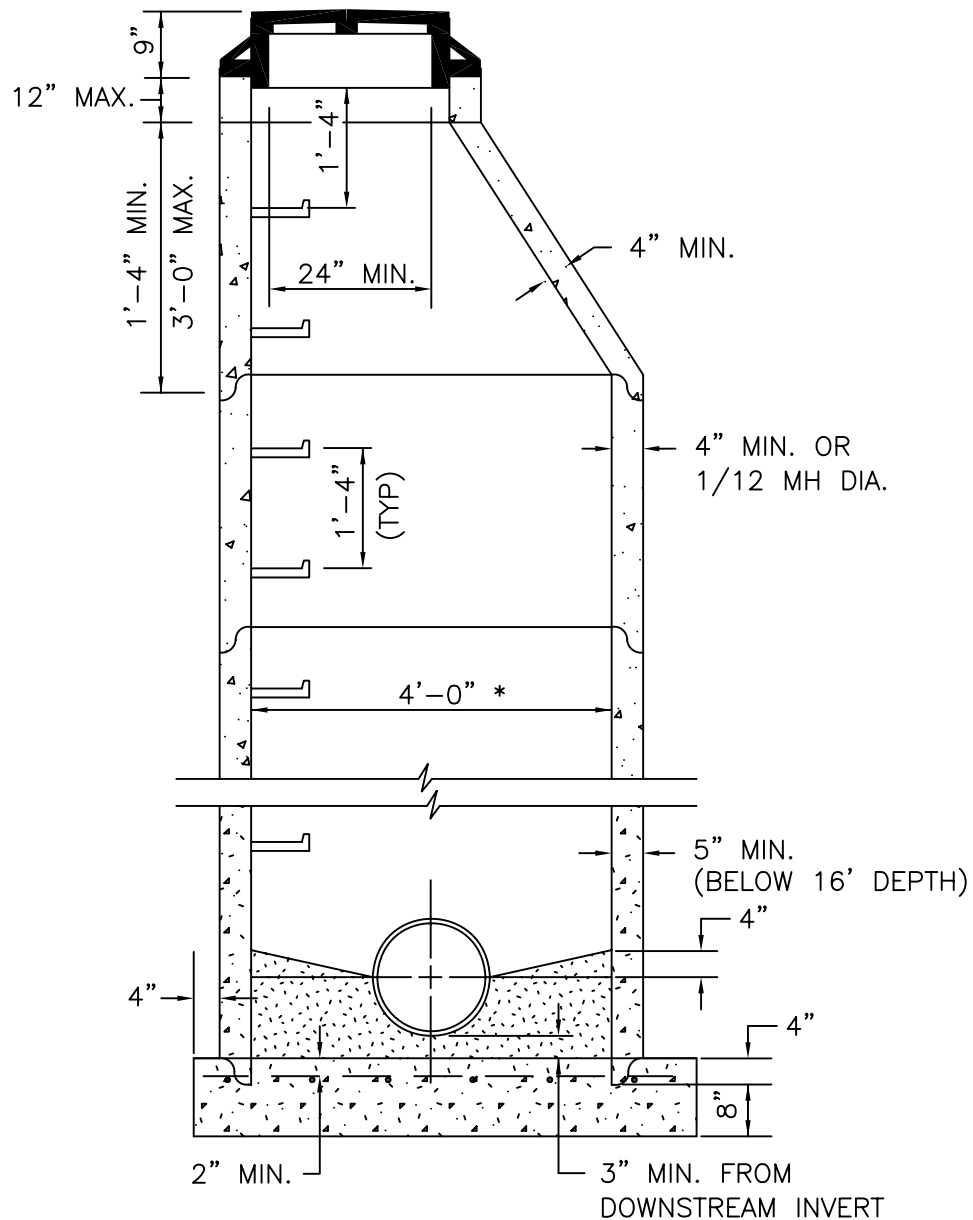
0201-0601-SD65



## NOTES:

1. THIS TAPPING DETAIL IS FOR D.I. PIPE ONLY. FOR ALL OTHER MATERIALS, SEE TAPPING DETAIL SHEET.

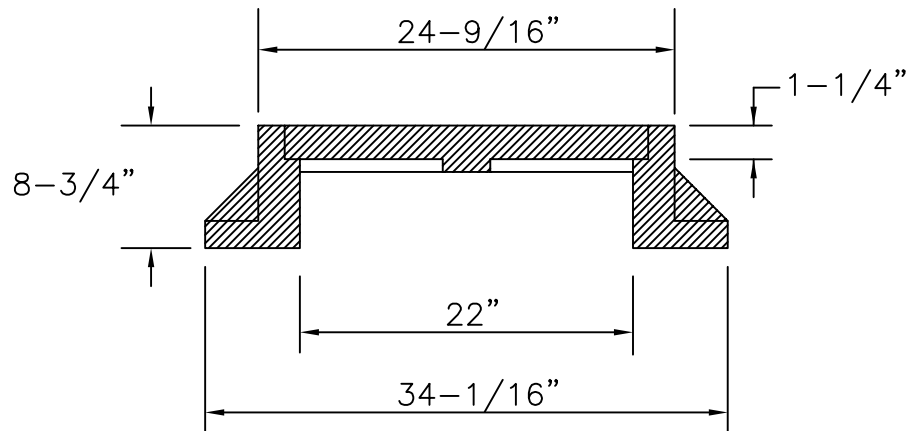
REVISIONS		AMERICAN WATER STANDARD CIVIL DEEP BURY AIR RELEASE VALVE ASSEMBLY DETAIL	
7/07 - MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		<div>AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075</div> <div> American Water®</div>	
		DRAWN BY RJB PROJECT ENG'R APPROVED	DATE 07-31-06 PROJECT IP
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0201-0601-SD66



\* UNLESS OTHERWISE NOTED ON PLANS


## STANDARD PRECAST MANHOLE (ECCENTRIC CONE)

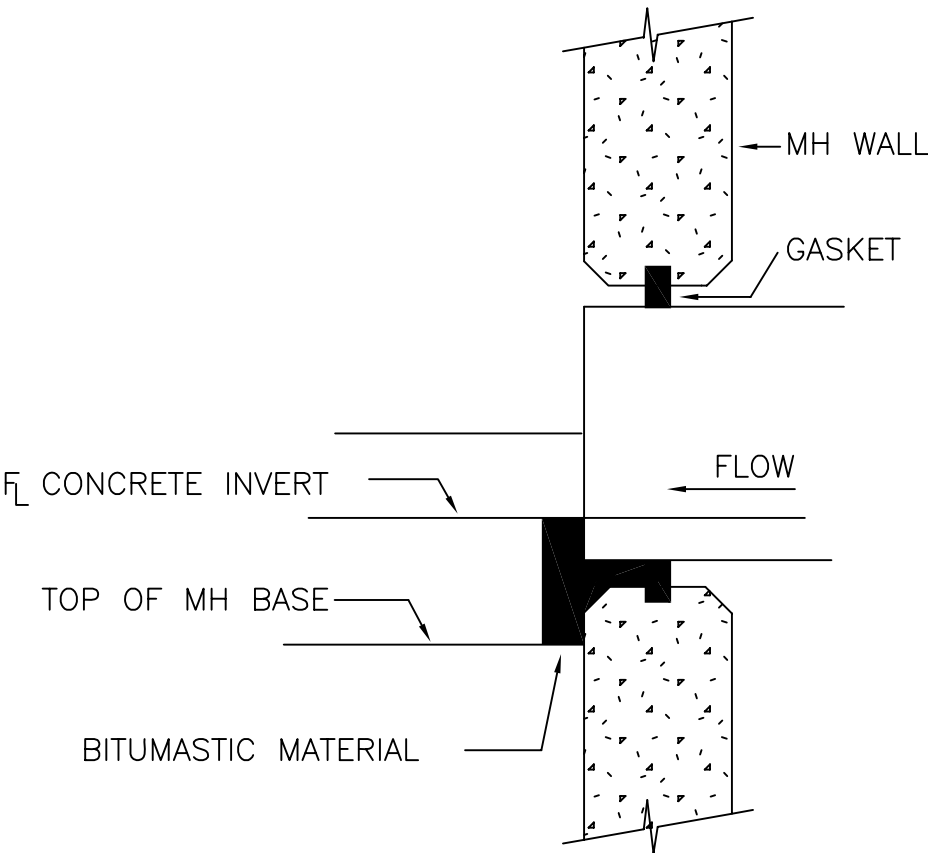
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		7/07 – MSG EDITS		
			AMERICAN WATER VOORHEES, NJ 08043	
			AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
			DRAWN BY RJB PROJECT ENG'R APPROVED	
			DATE 07-31-06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
			USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0202-0601-SD3




## MANHOLE COVER DETAIL

DEETER 1315 OR APPROVED EQUAL  
"SANITARY SEWER"  
CAST IN LID

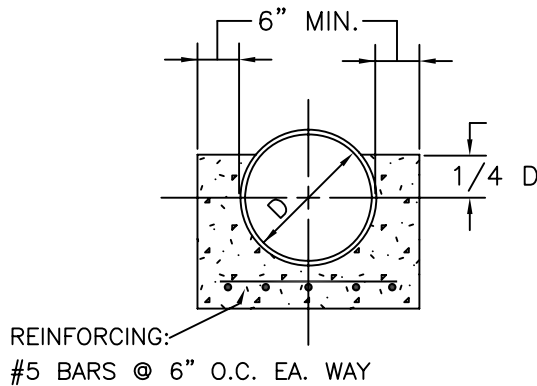
		REVISIONS		AMERICAN WATER STANDARD CIVIL MANHOLE COVER DETAIL		
		7/07 – MSG EDITS				
				AMERICAN WATER VOORHEES, NJ 08043		
				AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075		
				DRAWN BY RJB PROJECT ENG'R APPROVED	DATE 07–31–06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
				USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES		0202–0601–SD4



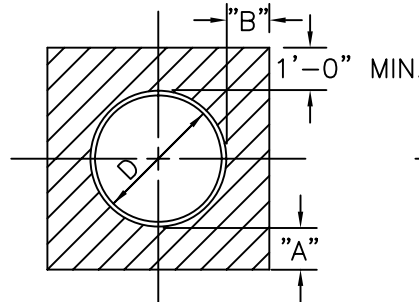
FLEXIBLE WALL CONNECTION

REVISIONS		AMERICAN WATER STANDARD CIVIL FLEXIBLE WALL CONNETION DETAIL	
7/07 - MSG EDITS		AMERICAN WATER VOORHEES, NJ 08043	
		<div>AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075</div> <div>American Water</div>	
		DRAWN BY RJB PROJECT ENG'R APPROVED	DATE 07-31-06 PROJECT IP USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0202-0601-SD5

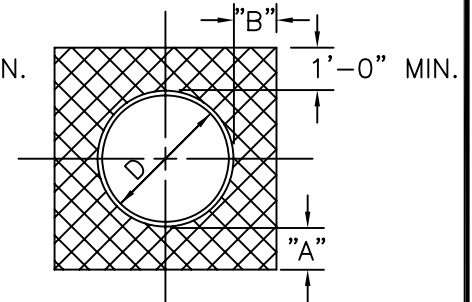
TYPE	P	LOAD FACTOR
REINFORCED	0.40%	3.5
REINFORCED	1.00%	4.8
PLAIN		2.8



STANDARD CONCRETE  
EMBEDMENT



CLASS "B" BEDDING  
(FLEXIBLE OR SEMI-  
FLEXIBLE PIPE)




CLASS "B" BEDDING  
(RIGID PIPE)

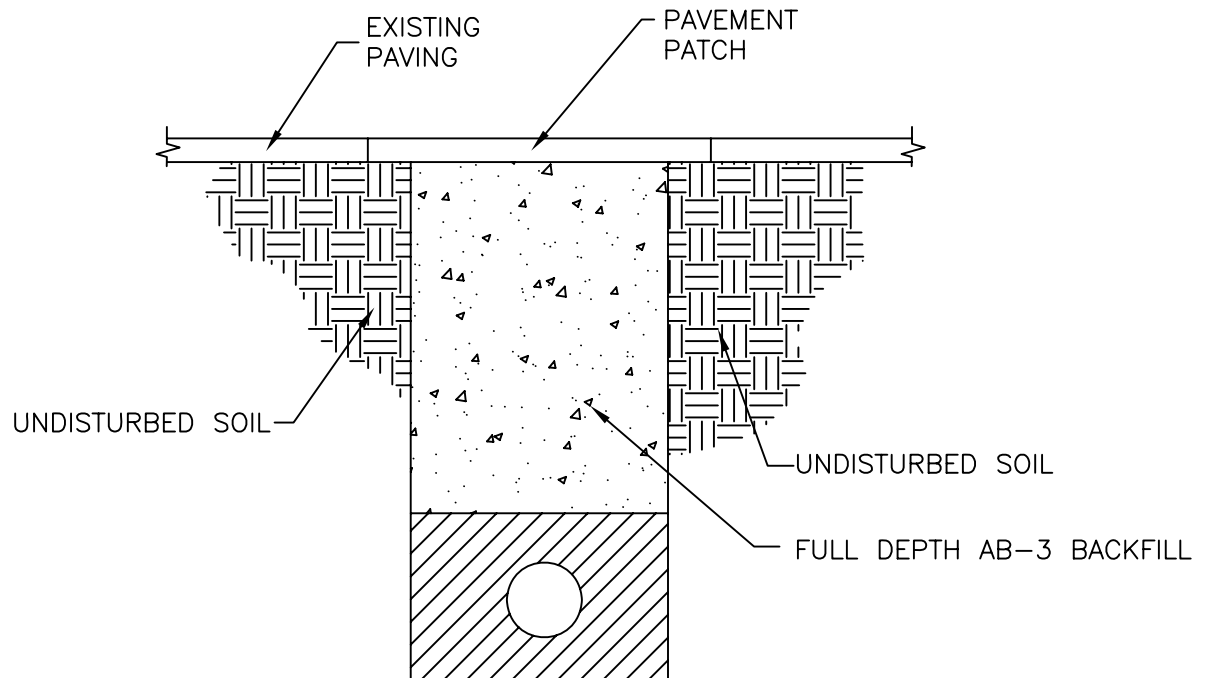
## STANDARD EMBEDMENTS

TABLE OF BEDDING DEPTHS & SIDE CLEARANCES				
D	ROCK		SOIL	
	A	B	A	B
4"-18"	6"	6"	4"	6"
21"-24"	9"	9"	4"	7"
27"-30"	9"	9"	4"	8"

	HAND PLACED & HAND TAMPED BACKFILL
	GRANDULAR FILL - KDOT CA-5
	CONCRETE


- D NOMINAL PIPE SIZE  
A FILL BELOW PIPE (SEE TABLE)  
B SIDE CLEARANCES (SEE TABLE)  
P AREA TRANSVERSE STEEL  
EXPRESSED AS A % OF AREA  
OF CONCRETE AT CROWN

REVISIONS		AMERICAN WATER STANDARD CIVIL STANDARD EMBEDMENTS DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
		 American Water •	
DRAWN BY RJB PROJECT ENG'R APPROVED		DATE 07-31-06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES		0202-0601-SD6	



## EXISTING ROAD CROSSING BACKFILL DETAIL

N.T.S.

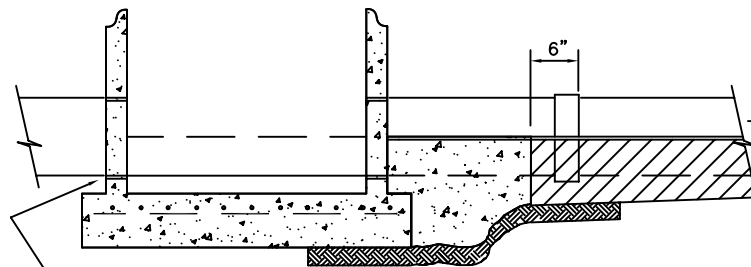
REVISIONS		AMERICAN WATER STANDARD CIVIL EXISTING ROAD CROSSING BACKFILL DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
		 American Water®	
DRAWN BY RJB PROJECT ENG'R APPROVED		DATE 07-31-06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES		0202-0601-SD7	

Information Only Subject to Revision

FINAL

Tuesday, January 17, 2012

0202-0601-SD7



THE MINIMUM DISTANCE BETWEEN THE INVERT OF THE DOWNSTREAM PIPE AND THE TOP OF THE MANHOLE BASE SHALL BE THREE (3) INCHES.

NOTES: 1ST JOINT OF PIPE SHALL BE EMBEDDED IN CONCRETE TO WITHIN 6" OF THE 1ST JOINT FOR RCP & VCP.

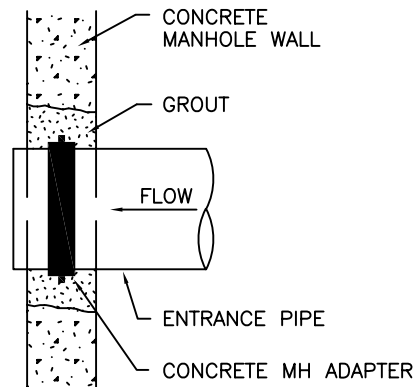
IF A FLEXIBLE WALL CONNECTION IS USED, CLASS B EMBEDMENT MAY BE USED.

IF FLEXIBLE OR SEMI-FLEXIBLE PIPE IS USED, A FLEXIBLE WALL CONNECTOR MUST BE USED.

FLEXIBLE WALL CONNECTIONS SHALL BE PRESS WEDGE, A-LOCK, PRESS-SEAL (PSX GASKET) OR APPROVED EQUAL.

## MANHOLE BASE SECTION


N.T.S.



## CONCRETE MANHOLE ADAPTER

N.T.S.

(USE FOR PIPES ENTERING EXISTING MANHOLE WALLS)

REVISIONS		AMERICAN WATER STANDARD CIVIL MANHOLE BASE SECTION & CONCRETE ADAPTER DETAIL	
7/07 – MSG EDITS			
		AMERICAN WATER VOORHEES, NJ 08043	
		AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075	
			
		DRAWN BY RJB PROJECT ENG'R APPROVED	
		DATE 07-31-06 PROJECT IP	USE DIMENSIONS ONLY SCALE N.T.S.
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0202-0601-SD8

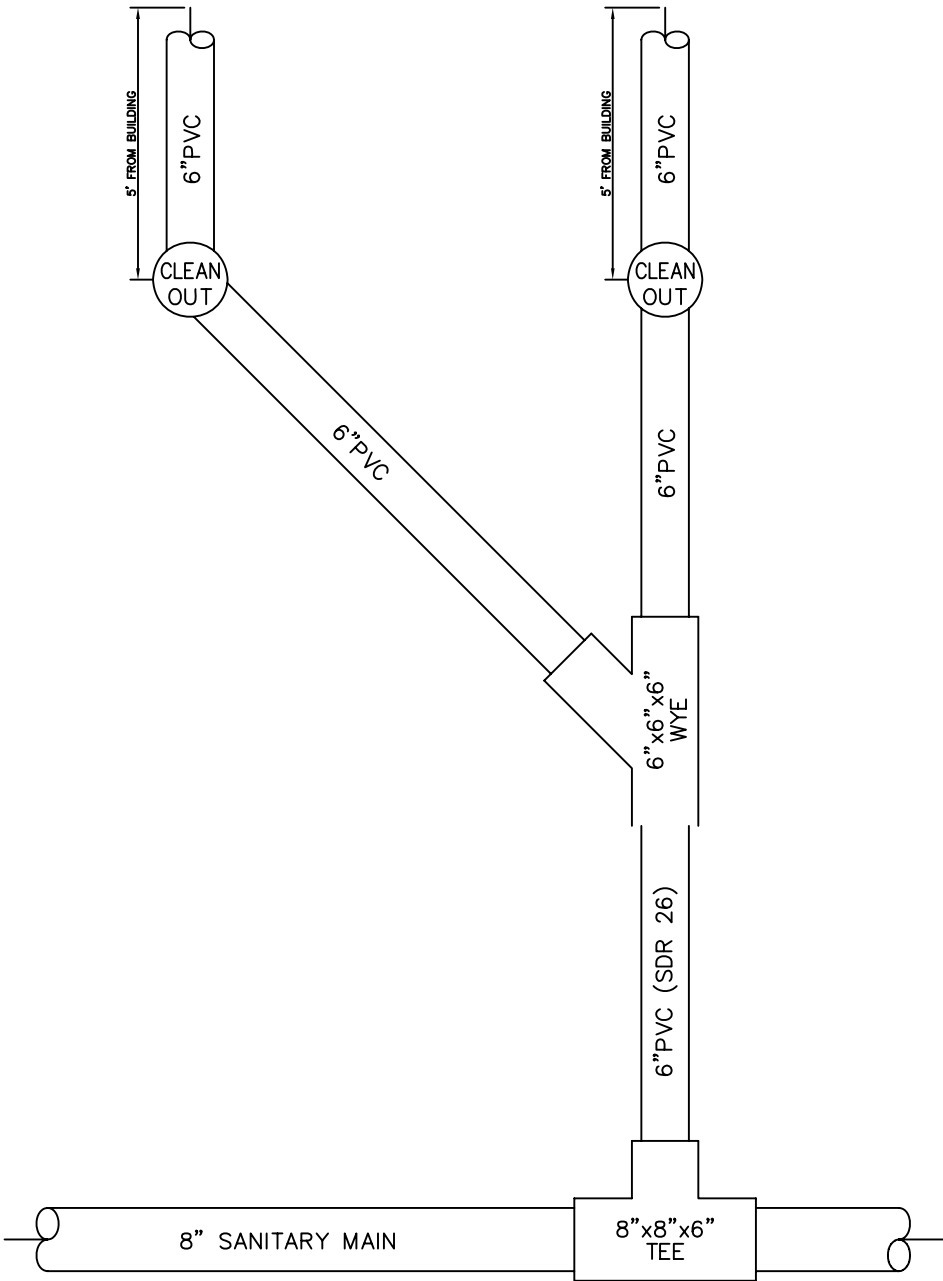
Information Only Subject to Revision

FINAL


Tuesday, January 17, 2012

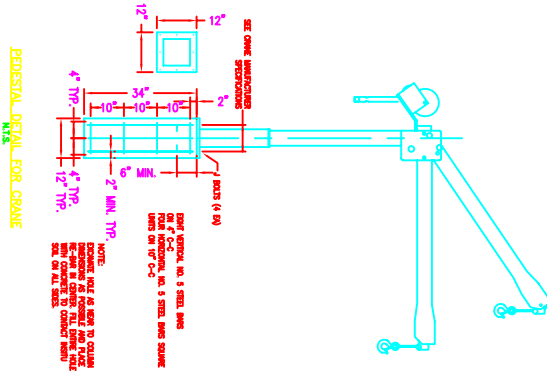
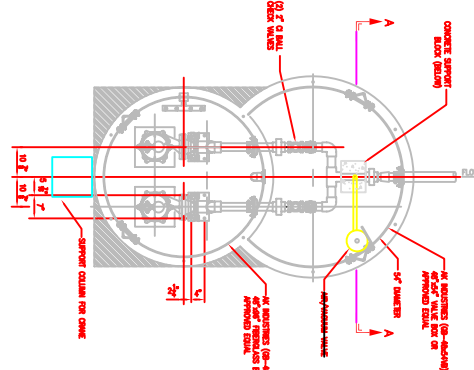
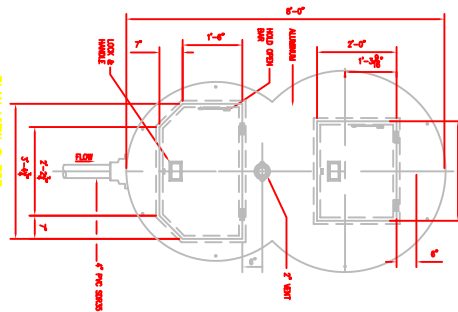
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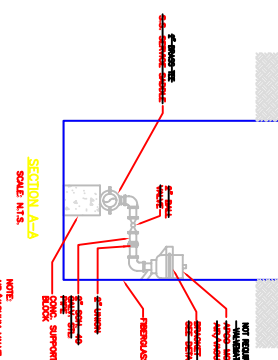
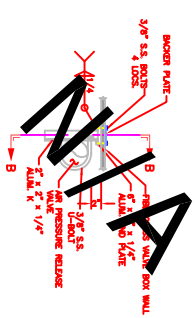
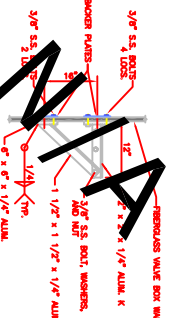


CLEANOUT PLAN DETAIL  
N.T.S.

	REVISIONS		AMERICAN WATER STANDARD CIVIL CLEANOUT PLAN DETAIL	
	7/07 – MSG EDITS			
			AMERICAN WATER VOORHEES, NJ 08043	
			<div>AMERICAN WATER ENG. CENTER 213 CARRIAGE LANE DELRAN, NJ 08075</div> <div>American Water</div>	
			<div>DRAWN BY RJB PROJECT ENG'R APPROVED</div> <div>DATE 07-31-06 PROJECT IP</div> <div>USE DIMENSIONS ONLY SCALE N.T.S.</div>	
		USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	0202-0601-SD9	

PLAN VIEW @ TOP  
PUMP STATION AND VALVE BOX  
N.T.S.PLAN VIEW @ BASE  
PUMP STATION AND VALVE BOX  
N.T.S.DETAIL FOR CRANE  
N.T.S.

ITEM	DESCRIPTION	QUANTITY	UNIT	PRICE	TOTAL
1	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00
2	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00
3	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00
4	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00
5	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00
6	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00
7	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00
8	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00
9	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00
10	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00

SECTION A-A  
SCALE: N.T.S.PLAN TYPICAL AIR RELEASE VALVE  
SUPPORT BRACKET DETAIL  
SCALE: N.T.S.SECTION C-C  
SCALE: N.T.S.

## PUMP STATION GENERAL NOTES

1. THE PUMP STATION SHALL BE DESIGNED TO OPERATE AT A FLOW RATE OF 100 GPM.
2. THE PUMP STATION SHALL BE DESIGNED TO OPERATE AT A HEAD OF 10 FEET.
3. THE PUMP STATION SHALL BE DESIGNED TO OPERATE AT A PRESSURE OF 10 PSI.
4. THE PUMP STATION SHALL BE DESIGNED TO OPERATE AT A TEMPERATURE OF 70°F.
5. THE PUMP STATION SHALL BE DESIGNED TO OPERATE AT A HUMIDITY OF 50%.
6. THE PUMP STATION SHALL BE DESIGNED TO OPERATE AT A VIBRATION OF 0.1 G.
7. THE PUMP STATION SHALL BE DESIGNED TO OPERATE AT A NOISE LEVEL OF 85 DBA.
8. THE PUMP STATION SHALL BE DESIGNED TO OPERATE AT A SEISMIC RISK OF 0.2 G.
9. THE PUMP STATION SHALL BE DESIGNED TO OPERATE AT A CORROSION RISK OF 0.1 MPY.
10. THE PUMP STATION SHALL BE DESIGNED TO OPERATE AT A FATIGUE RISK OF 0.1 MPY.

## EROSION BASIN DESIGN CRITERIA

1. THE EROSION BASIN SHALL BE DESIGNED TO OPERATE AT A FLOW RATE OF 100 GPM.
2. THE EROSION BASIN SHALL BE DESIGNED TO OPERATE AT A HEAD OF 10 FEET.
3. THE EROSION BASIN SHALL BE DESIGNED TO OPERATE AT A PRESSURE OF 10 PSI.
4. THE EROSION BASIN SHALL BE DESIGNED TO OPERATE AT A TEMPERATURE OF 70°F.
5. THE EROSION BASIN SHALL BE DESIGNED TO OPERATE AT A HUMIDITY OF 50%.
6. THE EROSION BASIN SHALL BE DESIGNED TO OPERATE AT A VIBRATION OF 0.1 G.
7. THE EROSION BASIN SHALL BE DESIGNED TO OPERATE AT A NOISE LEVEL OF 85 DBA.
8. THE EROSION BASIN SHALL BE DESIGNED TO OPERATE AT A SEISMIC RISK OF 0.2 G.
9. THE EROSION BASIN SHALL BE DESIGNED TO OPERATE AT A CORROSION RISK OF 0.1 MPY.
10. THE EROSION BASIN SHALL BE DESIGNED TO OPERATE AT A FATIGUE RISK OF 0.1 MPY.

## ANTI-ROTATION CALCULATIONS

1. THE ANTI-ROTATION CALCULATIONS SHALL BE DESIGNED TO OPERATE AT A FLOW RATE OF 100 GPM.
2. THE ANTI-ROTATION CALCULATIONS SHALL BE DESIGNED TO OPERATE AT A HEAD OF 10 FEET.
3. THE ANTI-ROTATION CALCULATIONS SHALL BE DESIGNED TO OPERATE AT A PRESSURE OF 10 PSI.
4. THE ANTI-ROTATION CALCULATIONS SHALL BE DESIGNED TO OPERATE AT A TEMPERATURE OF 70°F.
5. THE ANTI-ROTATION CALCULATIONS SHALL BE DESIGNED TO OPERATE AT A HUMIDITY OF 50%.
6. THE ANTI-ROTATION CALCULATIONS SHALL BE DESIGNED TO OPERATE AT A VIBRATION OF 0.1 G.
7. THE ANTI-ROTATION CALCULATIONS SHALL BE DESIGNED TO OPERATE AT A NOISE LEVEL OF 85 DBA.
8. THE ANTI-ROTATION CALCULATIONS SHALL BE DESIGNED TO OPERATE AT A SEISMIC RISK OF 0.2 G.
9. THE ANTI-ROTATION CALCULATIONS SHALL BE DESIGNED TO OPERATE AT A CORROSION RISK OF 0.1 MPY.
10. THE ANTI-ROTATION CALCULATIONS SHALL BE DESIGNED TO OPERATE AT A FATIGUE RISK OF 0.1 MPY.

## PROJECT PERFORMANCE STANDARDS

1. THE PROJECT PERFORMANCE STANDARDS SHALL BE DESIGNED TO OPERATE AT A FLOW RATE OF 100 GPM.
2. THE PROJECT PERFORMANCE STANDARDS SHALL BE DESIGNED TO OPERATE AT A HEAD OF 10 FEET.
3. THE PROJECT PERFORMANCE STANDARDS SHALL BE DESIGNED TO OPERATE AT A PRESSURE OF 10 PSI.
4. THE PROJECT PERFORMANCE STANDARDS SHALL BE DESIGNED TO OPERATE AT A TEMPERATURE OF 70°F.
5. THE PROJECT PERFORMANCE STANDARDS SHALL BE DESIGNED TO OPERATE AT A HUMIDITY OF 50%.
6. THE PROJECT PERFORMANCE STANDARDS SHALL BE DESIGNED TO OPERATE AT A VIBRATION OF 0.1 G.
7. THE PROJECT PERFORMANCE STANDARDS SHALL BE DESIGNED TO OPERATE AT A NOISE LEVEL OF 85 DBA.
8. THE PROJECT PERFORMANCE STANDARDS SHALL BE DESIGNED TO OPERATE AT A SEISMIC RISK OF 0.2 G.
9. THE PROJECT PERFORMANCE STANDARDS SHALL BE DESIGNED TO OPERATE AT A CORROSION RISK OF 0.1 MPY.
10. THE PROJECT PERFORMANCE STANDARDS SHALL BE DESIGNED TO OPERATE AT A FATIGUE RISK OF 0.1 MPY.

ITEM	DESCRIPTION	QUANTITY	UNIT	PRICE	TOTAL
1	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00
2	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00
3	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00
4	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00
5	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00
6	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00
7	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00
8	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00
9	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00
10	CONCRETE SUPPORT BLOCK (VALVE)	1	EA	100.00	100.00

FT. RUCKER

GIVEN: STUFF-15-2819020 WASTE WATER PUMP/VIP/CIVIL IMAGES-XREFS.Y

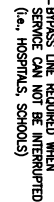
VICINITY MAP

HANCHET CLASSROOM PUMP STATION  
CIVIL  
SANITARY SEWER PUMP STATION  
DETAILS

AMERICAN WATER SERVICE GROUP

AMERICAN WATER  
SOLUTIONSAMERICAN WATER  
SOLUTIONSAMERICAN WATER  
SOLUTIONS



[illegible]

MODEL NO.	DIMENSIONS				UNIT WT.
	A	B	C	D	
H1W3030	30"	42 1/2"	30"	37 1/2"	104 LBS.

1. PRECAST CONCRETE RUMP SLAB AND WALL BOX SHALL BE DESIGNED BY ENGINEER. ALL CALCULATIONS SHALL BE SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF NEW YORK.
- A. STRUCTURE EMBED TO TOP WITH NO EXTERNAL SOIL PRESSURE.
- B. STRUCTURE EMPTY WITH SOIL BACKFILL TO FINISHED GRADE. ASSUME SOIL 90 PERCENT AIR TO 15% C.F. ASSUME SOIL SHOWN TO FINISHED GRADE.
- C. STRUCTURE SHALL NOT FLOW WITH SATURATED SOIL TO FINISHED GRADE. ASSUME SOIL 90 PERCENT AIR TO 15% C.F. ASSUME SOIL SHOWN TO FINISHED GRADE.
- D. SAFETY FACTOR OF 1.5 SHALL BE PROVIDED IN THE FLOATION CALCULATIONS.
- E. SOIL BEHAVING PRESSURE OF 2,500 P.S.I.
- F. EFFECTS OF ALL VERTICAL LOADS ANTICIPATED ON THE STRUCTURE SHALL BE INCLUDED IN THE ANALYSIS AND DESIGN. DESIGN SHALL BE FOR THE MAXIMUM OF THE FOLLOWING LOADS:
  - 1. DEAD LOAD, INCLUDING WEIGHT OF PRECAST STRUCTURES, SLABING, FLOORING, AND ACTUAL DEPTH OF SOIL COVER SHALL BE INCLUDED.
- G. PRECAST WALLBOX STEPS SHALL BE MADE OF POLYPROPYLENE ENCASED STEEL AS MANUFACTURED BY IJA INDUSTRIES AND SHALL CONFORM TO ASTM C900.
- H. THE EXTERIOR OF ALL PRECAST PRODUCTS SHALL BE COATED WITH TWO COATS OF POLYURETHANE EPOXY RESIN. THE INTERIOR SHALL BE COATED WITH PROWEATHER 800 COAT 100% WATERPROOFING UNMANUFACTURED BY PROCEAL COATING, INC.

Diagram illustrating the dimensions and components of a window frame:

- A. CLEAR OPENING:** The inner opening of the window frame, labeled as 9 3/4 inches.
- B. OVERALL:** The total height of the window frame, labeled as 12 1/2 inches.
- C. CLEAR OPENING:** The inner opening of the window frame, labeled as 3 3/4 inches.
- D. OVERALL:** The total width of the window frame, labeled as 12 1/2 inches.
- STAINLESS STEEL:** The material used for the window frame.
- LIFTING HANDLE:** The handle used to operate the window.

LINK-TYPE COMPRESSION SEAL W/ WALL SLEEVE (OR EQUAL)

D.I. PIPE

CONCRETE PIPE SUPPORT

12"

3' MIN

(SCALE: NTS)

METER SIZE	METER VAULT DIMENSIONS			
	A	B	C	D
3"	12'-4"	7'-0"	4'-0"	6"
4"	12'-4"	7'-0"	4'-0"	8"
6"	12'-4"	7'-0"	4'-0"	8"
8"	12'-4"	7'-0"	4'-0"	8"
10"	12'-4"	7'-0"	4'-0"	8"
12"	12'-4"	7'-0"	4'-0"	8"
> 12"	CONTACT AMERICAN WATER			

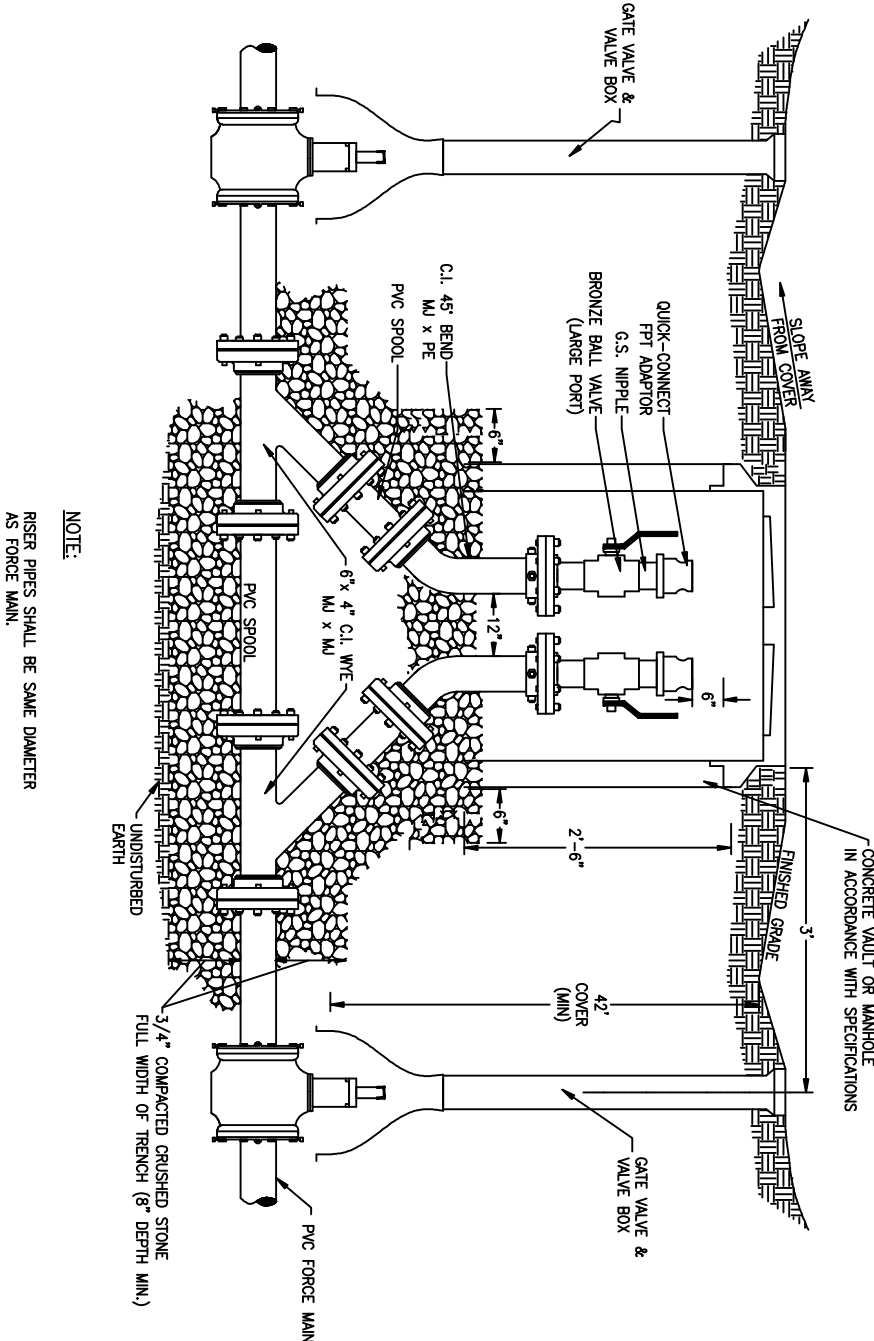
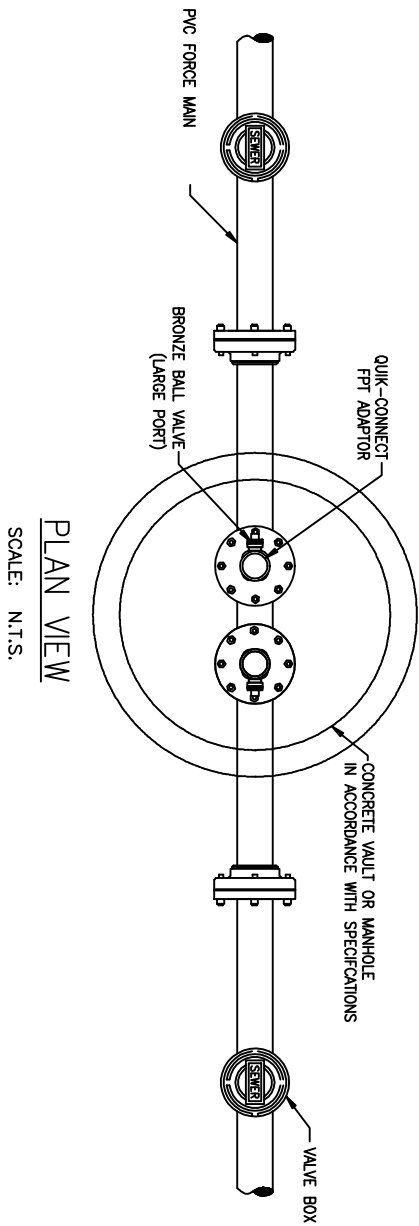
(SCALE: NTS)

**NOTES:**

- 1) SUITABLE FOR USE IN OFF STREET LOCATION WHERE NOT SUBJECTED TO HIGH DENSITY TRAFFIC.
- 2) PROVIDE A FULL BED OF CLASS "A" CONCRETE UNDER FRAME AND SUPPORT ANGLES.

1. PRECAST CONCRETE WALL, STATION AND VALVE BOX SHALL BE DESIGNED BY ENGINEER. ALL CALCULATIONS SHALL BE SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF NEW YORK.
- A. STRUCTURE FILLED TO TOP WITH NO EXTERNAL SOIL PRESSURE.
- B. ASSUMED 10% SURFACE DRAINAGE, 5% (5% CFS) ASSUME SOIL SHOWN TO FINISHED GRADE.
- C. STRUCTURE ASSUME 50% UNFILLED SATURATED SOIL TO FINISHED GRADE AND 50% UNFILLED SATURATED SOIL TO FINISHED GRADE. A SAFETY FACTOR OF 1.5 SHALL BE PROVIDED IN THE FLOWATION CALCULATIONS.
- D. SOIL BEHAVIOR PRESSURE OF 2,500 PSI.
- E. EFFECTS OF ALL VERTICAL LOADS ANTICIPATED ON THE FINISHED STRUCTURE SHALL BE INCLUDED IN THE ANALYSIS AND DESIGN. ANALYSIS SHALL INCLUDE ALL KNOWN AND ANTICIPATED VERTICAL LOADS, SMALL TO LARGE LOADS, AND ACTUAL DEPTH OF SOIL COVER SHALL BE INCLUDED.
2. PRECAST MANHOLE STEPS SHALL BE MADE OF POLYPROPYLENE ENCASED STEEL AS MANUFACTURED BY IJA INDUSTRIES AND SHALL CONFORM TO ASTM C900.
3. THE EXTERIOR OF ALL PRECAST PRODUCTS SHALL BE COATED WITH TWO COATS OF EPOXY RESIN. ALL PRECAST PRODUCTS SHALL BE PROVIDED WITH PROTECTIVE 800 GALT LPM WATERPROOFING MANUFACTURED BY PROCEAL COATING, INC.

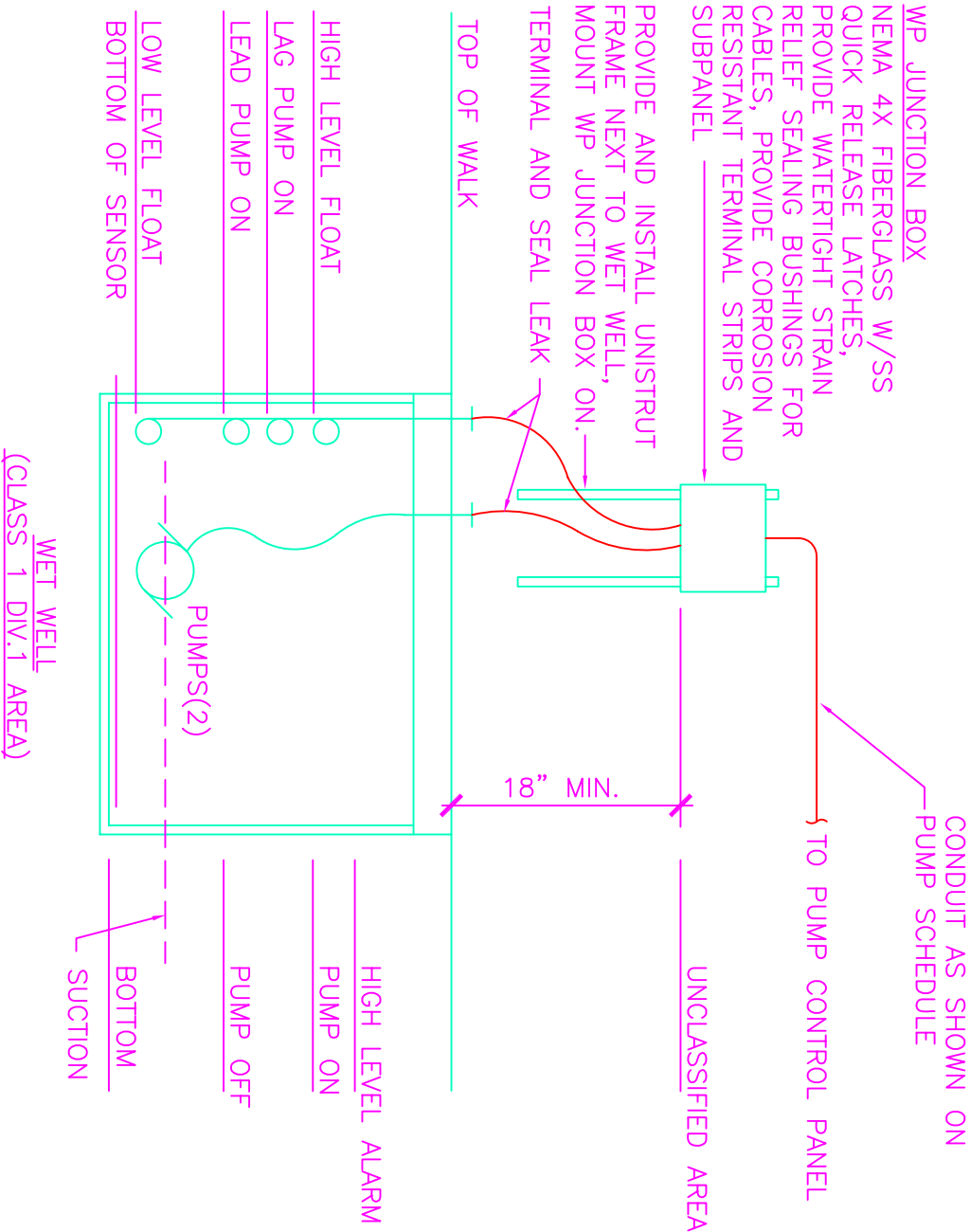
1. ALL PPE AND FITTINGS TO BE THE SAME SIZE AS THE WEARER.
2. REDUCERS ARE FORWARDED OUT, WITH PUMP ALTERNATION FROM AMBISON WEAR.
3. ALL PUMP BETWEEN THE TEES SPENTIAL AND DOWNSTREAM OF THE WEAR SHALL BE DOUBLE NON PPE.
4. WHEN COMPLETED WATER LINES SHALL BE DISCONNECTED IN ACCORDANCE WITH AMBISON WATER SHOWN SPECIFICATIONS.
5. WATER LINES 1" AND GREATER SHALL BE MARKING UP THROUGH METERS WITH MARKING DOUBLE NOON PIP STILE AND C/W 4'-FEET OF AMBISON WEL. NO SUBSTITUTIONS WILL BE ACCEPTED.
6. THUNDER WERE REQUIRED FROM EXISTING WATER MAIN TO WATER WALL.
7. FOR WATER MAINS APPLICATIONS GREATER THAN 12" DESIGN DOWNHILL SHALL COMBINE WITH AMBISON WATER.
8. 12" AND GREATER WATER MAINS SHALL BE DISCONNECTED TO THE EXISTING RETENTION TANK. MINIMAL CHANGES SHALL STILL BE PROVIDED.
9. THINEST BLOBS REQUIRED ON ALL BRINGS LIKE FITTINGS.



NOTE:  
RISER PIPES SHALL BE SAME DIAMETER  
AS FORCE MAIN.

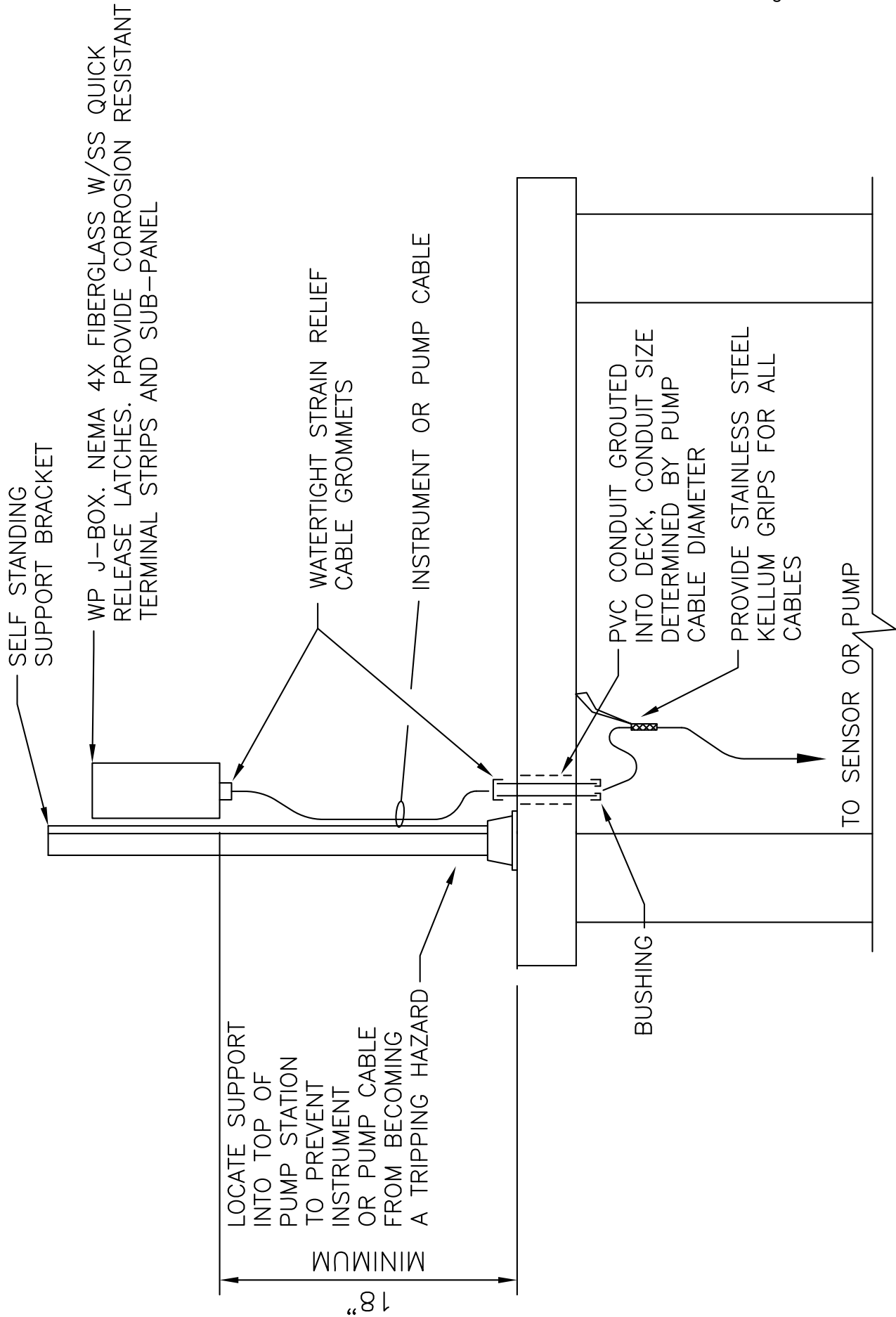
FORCE MAIN CLEAN OUT MANHOLE

SCALE: N.T.S.



Gf 3/51

PUMP STATION  
CONTROL WIRING DETAIL  
NO SCALE



N.T.S.

INSTRUMENTATION AND MOTOR CABLE JUNCTION BOX DETAIL

## Appendix KK

### AMERICAN WATER MILITARY SERVICES GROUP WATER & SEWER PLAN CHECKLIST





## AMERICAN WATER MILITARY SERVICES GROUP WATER & SEWER PLAN CHECKLIST

**Project Name:** \_\_\_\_\_

**Location:** \_\_\_\_\_

**Developer/Agency Name:** \_\_\_\_\_ **Developer/Agency Contact Number:** \_\_\_\_\_

**Engineer:** \_\_\_\_\_ **Engineer Contact Number:** \_\_\_\_\_

**Plan Date:** \_\_\_\_\_ **Submittal Date:** \_\_\_\_\_ **Submittal Number:** \_\_\_\_\_  
(or latest revision date)

### A. PLAN EVALUATION

	Description	YES	NO	N/A	Comments
	<b>Applicant Requirements</b>				
<i>The following section shall be completed by the applicant whereby they acknowledge administrative requirements as set forth by American Water for the applicant and their contractor.</i>					
	Developer shall provide two copies of final plan to Utility Manager.				
	Contractor shall coordinate with Utility Manager for inspection of work and connections to AW systems.				



	As-built plans shall be submitted in electronic form to AW upon completion of the project.				
	Backflow preventers are required on all connections to the existing water system.				
	All testing procedures shall be in accordance with AW standards.				
	Tracer wire to be provided on all water services.				
	All performance testing observation requires 72 hours notice.				
	Shop drawings shall be submitted to AW for review and approval prior to construction.				
	<b>Engineering Review</b>				
<i>The design engineer shall indicate the page number for each item listed in the left hand column unless the item does not appear on the plans submitted. The remainder of the columns shall be completed by American Water engineering staff.</i>					
<b>Pg.#</b>	<b>General</b>				
	American Water Permit Application				
	Standard Water and Sewer Construction Notes				
	Existing conditions plan				
	Demolition plan				
	Stand alone utility plan				
	Point of demarcations identified				



<b>Pg.#</b>	<b>Water</b>				
	Pipe location and alignment				
	Pipe size				
	Pipe material				
	Detail of connection to existing system				
	Location and size of all valves				
	Thrust blocks provided at all bends and tees				
	Location of existing and proposed fire hydrants				
	Pressure flow test results				
	Proposed water meter size and location				
	Proposed backflow preventer location. (Inside/outside of building)				
	Flushing hydrant or automatic flushing station provided on dead end mains.				
	Proposed water main extensions are > 8" in diameter.				
	Design flows provided (ADD)				
	Design fire flows provided				
	Minimum cover of 42" provided over all mains				
	PIV provided on all fire service lines				

	Proposed pipe material meets AW material specifications				
	Proposed fire hydrant manufacturer is Mueller				
	Spacing of hydrants is less than 500' (300' in warehouse districts)				
	Air release valves provided at all high points.				
	*Proposed wells shown on plans and calculations provided.				
	*Proposed tanks shown on plans and calculations provided.				
	*Proposed booster station shown on plans and calculations provided.				
<i>* Proposed projects that include the construction of wells, storage tanks, or booster station shall receive a more detailed review that is beyond the scope of this checklist.</i>					
<b>Pg.#</b>	<b>Sewer</b>				
	Pipe location and alignment				
	Projected flow calculations provided				
	Pipe size				
	Pipe material				
	Minimum cover of 42" provided over all sewer lines				
	Proposed pipe material meets AW material specifications				

	Gravity sewer meets minimum slope requirements				
	Adequate vertical and horizontal clearance provided at all utility crossings.				
	Two-way cleanouts provided at POD and shown on plan				
	Proposed manholes are of concrete construction				
	All invert elevations are provided on plans				
	Minimum internal manhole diameter is 4' (5' for manhole depths > 15')				
	Drop manholes provided where invert difference is >24"				
	Drop manholes are provided with outside drops.				
	Force main receiving manholes provided with corrosion protection				
	Proposed force mains are minimum of 4" in diameter (grinder pumps excluded)				
	Force main provides minimum velocity of 2 ft/sec.				
	Force main bends 45 <sup>0</sup> or less.				
	Air release valves provided at all high points along force main.				

	*Oil-water separator location shown on plans.				
	*Grease trap location shown on plans. Grease traps are required on all sewer lines that serve kitchen facilities.				
	*Holding tank location shown on plans.				
<i>* Proposed projects that include the construction of septic systems, oil-water separators, grease traps, and holding tanks shall receive a more detailed review that is beyond the scope of this checklist.</i>					
	<b>Lift stations</b>				
	Lift station calculations provided				
	Minimum of two pumps provided				
	Design peak hourly flow handled with largest pump out of service.				
	Pumps capable of passing a 3" solid sphere.				
	Bypass pumping capability provided.				
	Adequate ventilation provided.				
	Electrical design provided.				
	Back-up power provided.				
	Lift station flotation calculations provided.				
	Shutoff and check valves provided on each pump discharge line.				
	All piping material in wet well is stainless steel.				



	All valves are provided in separate valve vault.				

## Appendix LL

### FORT BELVOIR FIRE DEPARTMENT PRE-CONSTRUCTION CONFERENCE REPORT



**FORT BELVOIR FIRE DEPARTMENT  
PRE-CONSTRUCTION CONFERENCE REPORT**

DATE_____	
FIRE INSPECTOR_____	
GOVERNMENT POC_____	
PHONE NUMBER_____	FIRE DEPARTMENT EMERGENCY
PROJECT LOCATION_____	781-1800
PROJECT TITLE_____	
CONTRACT NUMBER_____	FIRE DEPARTMENT BUSINESS
PRIMARY CONTRACTOR_____	806-6911
ADDRESS_____	
OFFICE PHONE NUMBER_____	FIRE INSPECTOR OFFICE
24-HOUR PHONE NUMBER_____	805-2091
PROJECTED START DATE_____	

THE CONTRACTOR WAS BRIEFED AND ADVISED OF THE FOLLOWING ITEMS:

1. Prior to using any heat producing equipment a Hot-Work Permit (DA 5383-R) must be obtained from a fire department representative.
2. All tanks for oxygen, acetylene, LPG, etc. must be properly secured against tipping over. Tanks must be equipped with working gauges and hoses in good condition. All tanks must have shutoff valves and when not in use safety caps must be in place.
3. All flammable/combustible liquids must be stored in a metal cabinet marked "FLAMMABLE" or removed from the jobsite daily.
4. The Contractor shall provide a sufficient number of approved and serviceable fire extinguishers of not less than ten (10) pound capacity dry chemical type with ABC rating, the number to be determined by criteria developed by the Fire Prevention Office. All trailers on the jobsite shall be equipped with at least one (1) such extinguisher.
5. All trash shall be removed from the jobsite at the end of each working day.
6. There shall be at least one person on the jobsite who can speak and understand English.
7. The Contractor shall instruct all employees in the correct and required procedures to be taken in the event of a fire on the jobsite (notification, evacuation, etc.)
8. ALL FIRES REGARDLESS OF SIZE MUST BE REPORTED TO THE FIRE DEPARTMENT IMMEDIATELY, EVEN IF EXTINGUISHED.
9. Flammable/combustible liquids used on the jobsite shall be stored in approved metal safety cans in good condition.
10. Fire hydrants, fire lanes, sprinkler/standpipe connections, and fire alarm boxes and control panels shall not be blocked so as to prevent immediate access. Fire hydrants shall not be used by the Contractor without prior authorization by the Fire Department and other applicable departments. The Fire Department shall be notified whenever any roadway is blocked or any fire hydrant or water main is shut down by the Contractor.
11. There shall be no smoking in any work area at any time.

BY THE SIGNATURES BELOW THE CONTRACTOR ACKNOWLEDGES RECEIPT OF THIS BRIEFING AND AWARENESS OF APPLICABLE REGULATIONS AND PRECAUTIONS

\_\_\_\_\_  
CONTRACTOR REPRESENTATIVE

\_\_\_\_\_  
FIRE DEPARTMENT REPRESENTATIVE

Distribution: Original to Contractor, Copy to Fire Prevention Office

## Appendix T T – T & [ • Permit Forms & Case

**HOT-WORK PERMIT**

For use of this form, see AR 420-90; the proponent agency is ACSIM

1. LOCATION	2. DATE	3. PERMIT NO.
4. TYPE OF WORK	5. START TIME	6. FINISH TIME
7.a. NAME OF PERSON RESPONSIBLE FOR HOT-WORK AT JOB SITE <i>(Contractor/Government Employee)</i>	7.b. SIGNATURE	

**PRECAUTIONS BEFORE OPERATIONS**

CHECKLIST	CHECK ONE	
	YES	NO
8. Did Fire Department Inspector inspect site?		
9. Are there procedures for Fire Department emergency notification? <i>(Emergency No.)</i>		
10. Are combustibles in area noted?		
11. Should combustibles be covered? <i>(If yes, note in remarks)</i>		
12. Are proper extinguishers on hand?		
13. Is wet-down necessary? <i>(If yes, note in remarks)</i>		
14. Is smoking permissible at work sites?		
15. Is continuous fire watch required?		
16. Is Fire Department standby required?		
17. Are other precautions required? <i>(If yes, note in remarks)</i>		
18.a. FIRE DEPARTMENT INSPECTOR'S SIGNATURE	18.b. DATE	

**PRECAUTIONS AFTER OPERATIONS**

CHECKLIST	CHECK ONE	
	YES	NO
19.a. Was Fire Department notified after hot-work operation was completed?		
19.b. Time:		
20.a. Did Fire Department inspector inspect work site?		
20.b. Time:		
21. Are after work conditions safe? <i>(If no, note in remarks)</i>		
22. Are heat producing devices safe if left at work site?		
23.a. FIRE DEPARTMENT INSPECTOR'S SIGNATURE	23.b. DATE	
24. REMARKS		

**NOTE: PERMIT VALID ON DAY OF OPERATION AT ONE LOCATION ONLY**

**NOTICE OF PROPOSED CONSTRUCTION OR ALTERATION****§77.13 Construction or alteration requiring notice.**

(a) Except as provided in §77.15, each sponsor who proposes any of the following construction or alteration shall notify the Administrator in the form and manner prescribed in §77.17.

(1) Any construction or alteration of more than 200 feet in height above the ground level at its site.

(2) Any construction or alteration of greater height than imaginary surface extending outward and upward at one of the following slopes:

(i) 1 00 to 1 for horizontal distance of 20,000 feet from the nearest point of the nearest runway of each airport specified in paragraph (a)(5) or this section with at least one runway more than 3,200 feet in actual length, excluding heliports.

(ii) 50 to 1 for horizontal distance of 10,000 feet from the nearest point of the nearest runway of each airport specified in paragraph (a)(5) of this section with its longest runway no more than 3,200 feet in actual length, excluding heliports.

(iii) 25 to 1 for a horizontal distance of 5,000 feet from the nearest point of the nearest landing and takeoff area of each heliport specified in paragraph (a)(5) of this section.

(3) Any highway, railroad, or other traverse way for mobile objects, of a height which, if adjusted upward 17 feet for an Interstate Highway that is part of the National System of Military and Interstate Highways where overcrossings are designed for a minimum of 17 feet vertical distance, 16 feet for any other public roadway, 10 feet or the height of the highest mobile object that would normally traverse the road, whichever is greater, for a private road, 23 feet for a railroad, and for a waterway or any other traverse way not previously mentioned, an amount equal to the height of the highest mobile object that would normally traverse it, would exceed a standard of paragraph (a)(1) or (2) of this section.

(4) When requested by the FAA, any construction or alteration that would be in an instrument approach area (defined in the FAA standards governing instrument approach procedures) and available information indicates it might exceed a standard of Subpart C of this part.

(5) Any construction or alteration on any of the following airports (including heliports):

(i) An airport that is available for public use and is listed in the Airport Directory of the current Airman's Information Manual or in either the Alaska or Pacific Airman's Guide and Chart Supplement.

(ii) An airport under construction, that is the subject of a notice or proposal on file with the Federal Aviation Administration, and except for military airports, it is clearly indicated that airport will be available for public use.

(iii) An airport that is operated by an armed force of the United States.

(b) Each sponsor who proposes construction or alteration that is the subject of a notice under paragraph (a) of this section and is advised by an FAA regional office that a supplemental notice is required shall submit that notice on a prescribed form to be received by the FAA regional office at least 48 hours before the start of construction or alteration.

(c) Each sponsor who undertakes construction or alteration that is the subject of a notice under paragraph (a) of this section shall, within 5 days after that construction or alteration reaches its greatest height, submit a supplemental notice on a prescribed form to the FAA regional office having jurisdiction over the region involved, if –

(1) The construction or alteration is more than 200 feet above the surface level of its site; or

(2) An FAA regional office advises him that submission of the form is required.

**§77.15 Construction or alteration not requiring notice.**

No person is required to notify the Administrator for any of the following construction or alteration:

(a) Any object that would be shielded by existing structures of a permanent and substantial character or by natural terrain or topographic features of equal or greater height, and would be located in the congested area of a city, town, or settlement where it is evident beyond all reasonable doubt that the structure so shielded will not adversely affect safety in air navigation.

(b) Any antenna structure of 20 feet or less in height except one that would increase the height of another antenna structure.

(c) Any air navigation facility, airport visual approach or landing air, aircraft arresting device, or meteorological device, of a type approved by the Administrator, or an appropriate military service on military airports, the location and height of which is fixed by its functional purpose.

(d) Any construction or alteration for which notice is required by any other FAA regulation.

**§77.17 Form and time of notice**

(a) Each person who is required to notify the Administrator under §77.13 (a) shall send one executed form set of FAA Form 7460-1, Notice of Proposed Construction or Alteration, to the Manager, Air Traffic Division, FAA Regional Office having jurisdiction over the area within which the construction or alteration will be located. Copies of FAA Form 7460-1 may be obtained from the headquarters of the Federal Aviation Administration and the regional offices.

(b) The notice required under §77.13 (a)(1) through (4) must be submitted at least 30 days before the earlier of the following dates –

(1) The date the proposed construction or alteration is to begin.

(2) The date an application for a construction permit is to be filed.

However, a notice relating to proposed construction or alteration that is subject to the licensing requirements of the Federal Communications Act may be sent to the FAA at the same time the application for construction is filed with the Federal Communications Commission, or at any time before that filing.

(c) A proposed structure or an alteration to an existing structure that exceeds 2,000 feet in height above the ground will be presumed to be a hazard to air navigation and to result in an inefficient utilization of airspace and the applicant has the burden of overcoming that presumption. Each notice submitted under the pertinent provisions of this part 77 proposing a structure in excess of 2,000 feet above ground, or an alteration that will make an existing structure exceed that height, must contain a detailed showing, directed to meeting this burden. Only in exceptional cases, where the FAA concludes that a clear and compelling showing has been made that it would not result in an inefficient utilization of the airspace and would not result in a hazard to air navigation, will a determination of no hazard be issued.

(d) In the case of an emergency involving essential public services, public health, or public safety that required immediate construction or alteration, the 30 day requirement in paragraph (b) of this section does not apply and the notice may be sent by telephone, telegraph, or other expeditious means, with an executed FAA Form 7460-1 submitted within five (5) days thereafter. Outside normal business hours, emergency notices by telephone or telegraph may be submitted to the nearest FAA Flight Service Station.

(e) Each person who is required to notify the Administrator by paragraph (b) or (c) of §77.13, or both shall send an executed copy of FAA Form 7460-2, Notice of Actual Construction or Alteration, to the Manager, Air Traffic Division, FAA Regional Office having jurisdiction over the area involved.

**Mail Processing Center**  
**Federal Aviation Administration**  
**Southwest Regional Office Obstruction Evaluation Service, AJR-322**  
**2601 Meachum Boulevard**  
**Fort Worth, TX 76193**  
**Fax: 817-838-1991**  
**Phone: 817-838-1990**

**Website: <https://oeaaa.faa.gov>**

**INSTRUCTIONS FOR COMPLETING FAA FORM 7460-1****PLEASE TYPE or PRINT**

**ITEM #1.** Please include the name, address and phone number of a personal contact point as well as the company name.

**ITEM #2.** Please include the name, address and phone number of a personal contact point as well as the company name.

**ITEM #3.** New Construction would be a structure that has not yet been built.

Alteration is a change to an existing structure such as the addition of a side mounted antenna, a change to the marking and lighting, a change to power and/or frequency, or a change to the height. The nature of the alteration shall be included in **ITEM #21** "Complete Description of Proposal".

Existing would be a correction to the latitude and/or longitude, a correction to the height, or if filing on an existing structure which has never been studied by the FAA. The reason for the notice shall be included in **ITEM #21** "Complete Description of Proposal".

**ITEM #4.** If Permanent, so indicate. If Temporary, such as a crane or drilling derrick, enter the estimated length of time the temporary structure will be up.

**ITEM #5.** Enter the date that construction is expected to start and the date that construction should be completed.

**ITEM #6.** Please indicate the type of structure. **DO NOT LEAVE BLANK.**

**ITEM #7.** In the event that obstruction marking and lighting is required, please indicate type desired. If no preference, check "other" and indicate "no preference" **DO NOT LEAVE BLANK.** **NOTE:** *High Intensity lighting shall be used only for structures over 500' AGL.* In the absence of high intensity lighting for structures over 500' AGL, marking is also required.

**ITEM #8.** If this is an existing tower that has been registered with the FCC, enter the FCC Antenna Structure Registration number here.

**ITEM #9 and #10.** Latitude and longitude must be geographic coordinates, accurate to within the nearest second or to the nearest hundredth of a second if known. Latitude and longitude derived solely from a **hand-held GPS instrument is NOT acceptable.** A hand-held GPS is only accurate to within 100 meters (328 feet) 95 percent of the time. This data, when plotted, should match the site depiction submitted under **ITEM #20.**

**ITEM #11.** NAD 83 is preferred; however, latitude and longitude may be submitted in NAD 27. Also, in some geographic areas where NAD 27 and NAD 83 are not available other datums may be used. It is important to know which datum is used. **DO NOT LEAVE BLANK.**

**ITEM #12.** Enter the name of the nearest city and state to the site. If the structure is or will be in a city, enter the name of that city and state.

**ITEM #13.** Enter the **full** name of the nearest public-use (**not private-use**) airport or heliport or military airport or heliport to the site.

**ITEM #14.** Enter the distance **from** the airport or heliport listed in **#13 to the structure.**

**ITEM #15.** Enter the direction **from** the airport or heliport listed in **#13 to the structure.**

**ITEM #16.** Enter the site elevation above mean sea level and expressed in whole feet rounded to the nearest foot (e.g. 17'3" rounds to 17', 17'6" rounds to 18'). This data should match the ground contour elevations for site depiction submitted under **ITEM #20.**

**ITEM #17.** Enter the total structure height **above ground level** in **whole feet** rounded to the **next highest foot** (e.g. 17'3" rounds to 18'). **The total structure height shall include anything mounted on top of the structure, such as antennas, obstruction lights, lightning rods, etc.**

**ITEM #18.** Enter the overall height above mean sea level and expressed in **whole feet.** This will be the total of **ITEM #16 + ITEM #17.**

**ITEM #19.** If an FAA aeronautical study was previously conducted, enter the previous study number.

**ITEM #20.** Enter the relationship of the structure to roads, airports, prominent terrain, existing structures, etc. Attach an 8-1/2" x 11" non-reduced copy of the appropriate 7.5 minute U.S. Geological Survey (USGS) Quadrangle Map MARKED WITH A PRECISE INDICATION OF THE SITE LOCATION. To obtain maps, contact USGS at 1-800-435-7627 or via internet at "<http://mapping.usgs.gov>". If available, attach a copy of a documented site survey with the surveyor's certification stating the amount of vertical and horizontal accuracy in feet.

**ITEM #21.**

- For transmitting stations, include maximum effective radiated power (*ERP*) and all frequencies.
- For antennas, include the type of antenna and center of radiation (*Attach the antenna pattern, if available*).
- For microwave, include azimuth relative to true north.
- For overhead wires or transmission lines, include size and configuration of wires and their supporting structures (*Attach depiction*).
- For each pole/support, include coordinates, site elevation, and structure height above ground level or water.
- For buildings, include site orientation, coordinates of each corner, dimensions, and construction materials.
- For alterations, explain the alteration thoroughly.
- For existing structures, thoroughly explain the reason for notifying the FAA (*e.g. corrections, no record or previous study, etc.*).

**Filing this information with the FAA does not relieve the sponsor of this construction or alteration from complying with any other federal, state or local rules or regulations. If you are not sure what other rules or regulations apply to your proposal, contact local/state aviation and zoning authorities.**

**Paperwork Reduction Work Act Statement:** This information is collected to evaluate the effect of proposed construction or alteration on air navigation and is not confidential. Providing this information is mandatory for anyone proposing construction or alteration that meets or exceeds the criteria contained in 14 CFR, part 77. We estimate that the burden of this collection is an average 19 minutes per response. An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. The OMB control number for this collection is 2120-0001. Comments concerning the accuracy of this burden and suggestions for reducing the burden should be directed to the FAA at: 800 Independence Ave. SW, Washington, DC 20591, Attn: Information Collection Clearance Officer, ABA-20

Please Type or Print on This Form

Form Approved OMB No. 2120-0001  
Expiration Date: 9/30/2010



**U.S. Department of Transportation  
Federal Aviation Administration**

***Failure To Provide All Requested Information May Delay Processing of Your Notice***

# Notice of Proposed Construction or Alteration

**FOR FAA USE ONLY**

Aeronautical Study Number

[illegible]

TRANSMITTAL OF SHOPDRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE <small>(Read instructions on page two prior to initiating this form)</small>				DATE: Mo / Day / Yr / /		TRANSMITTAL NO --
SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS <small>(This section will be initiated by the contractor)</small>						
TO:		FROM:		CONTRACT NO. DAC		CHECK ONE: <input type="checkbox"/> THIS IS A NEW SUBMITTAL <input type="checkbox"/> THIS IS A RESUBMITTAL OF TRANSMITTAL
SPECIFICATION SEC NO. <small>(Cover only one section with each transmittal)</small>		PROJECT TITLE AND LOCATION				
ITEM NO.	DESCRIPTION OF ITEM SUBMITTED <small>(Type size, model number/etc.)</small>	MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. <small>(See instruction no. 8)</small>	NO. OF COPIES	CONTRACT SPEC. PARA NO.	REFERENCE DRAWING SHEET NO.	FOR CONTR- ACTOR USE CODE
a.	b.	c.	d.	e.	f.	h. i.
REMARKS		I certify that the above submitted items have been reviewed in detail and are correct and in strict compliance with the contract drawings and specifications except as other wise stated.				
NAME AND SIGNATURE OF THE CONTRACTOR						
SECTION II - APPROVAL ACTION						
ENCLOSURES RETURNED <small>(List by Item No.)</small>		NAME, TITLE OF APPROVING AUTHORITY			DATE	

INSTRUCTIONS

1. Section I will be initiated by the Contractor in the required numbers of copies.
2. Each transmittal shall be numbered consecutively in the space provided for "Transmittal No.". This number in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals mark the appropriate box; on resubmittals, insert transmittal number of last submission as well as the new submittal number.
3. The "Item No." will be the same "Item No." as indicated on ENG FORM 4288 for each entry on this form.
4. Submittals requiring expeditious handling will be submitted under a separate form.
5. Separate transmittal form will be used for submittals under separate sections of the specifications.
6. A check shall be placed in the "Variation" column when a submittal is not in accordance with the plans and specifications -- also a written statement to that effect shall be included in the space provided for "Remarks".
7. Form is self transmitting, letter of transmittal is not required.
8. When a sample of a material or Manufacturer's Certificate of Compliance is transmitted, indicate "Sample" or "Certificate" in column c, Section I
9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I, column I to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated in Section I, Column g, to each item submitted.

THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED

A --	Approved as submitted	E --	Disapproved (See Attached)
B --	Approved, except as noted on drawings.	F --	Receipt acknowledged
C --	Approved except as noted on drawings. Refer to attached sheet resubmission required.	FX --	Receipt acknowledged, does not comply as noted with contract requirements
D --	Will be returned by separate correspondence.	G --	Other (Specify)

10. Approval of items does not relieve the contractor from complying with all the requirements of the contract plans and specifications.

Reverse of ENG Form 4025



10/2006

Contractor's Name:	_____
Address:	_____
Phone Number:	_____

## CONSTRUCTION QUALITY CONTROL REPORT

PROJECT NAME: \_\_\_\_\_  
 LOCATION: \_\_\_\_\_ DATE: \_\_\_\_\_  
 CONTRACT NUMBER: \_\_\_\_\_ REPORT NO.: \_\_\_\_\_

SUPERINTENDENT: _____			
TYPE OF WORKERS	NUMBER	TYPES OF CONSTRUCTION EQUIPMENT ON SITE	NUMBER
SUBCONTRACTORS			
COMPANY	RESPONSIBILITY	FOREMAN	NO. OF WORKERS
TOTALS			
NO. OF WORKERS TODAY	MANHOURS TODAY	MANHOURS FOR THIS PERIOD	
CONTRACT MATERIALS AND EQUIPMENT DELIVERED TO SITE:			
WEATHER: _____ SITE CONDITIONS: _____			
DID A DELAY OR WORK STOPPAGE OCCUR TODAY? _____ IF YES, EXPLAIN.			
HAS ANYTHING DEVELOPED IN THE WORK WHICH MAY LEAD TO A CHANGE OR FINDING OF FACT? _____ IF YES, EXPLAIN.			

SECTION 01 45 00.00 10

PAGE 1 OF 3 PAGES

DESCRIPTION OF ALL WORK PERFORMED TODAY (LIST BY DEFINABLE FEATURES OF WORK)
PREPARATORY INSPECTION:  LIST ALL INSPECTIONS BY SUBJECT AND SPECIFICATION LOCATION. ATTACH MINUTES OF MEETING AND LIST OF ALL ATTENDEES.
HAVE ALL REQUIRED SUBMITTALS AND SAMPLES OF CONSTRUCTION BEEN APPROVED.
DO THE MATERIALS AND EQUIPMENT TO BE USED CONFORM TO THE SUBMITTALS?
HAS ALL PRELIMINARY WORK BEEN INSPECTED, TESTED, AND COMPLETED?
TEST REQUIRED AND INSPECTION TECHNIQUES TO BE EXECUTED TO PROVE CONTRACT COMPLIANCE (INCLUDE BOTH EXPECTED AND ACTUAL RESULTS)
HAS A PHASE HAZARD ANALYSIS BEEN PERFORMED?
COMMENTS AND DEFICIENCIES NOTED AND CORRECTIVE ACTIONS TAKEN:

ALL INSTRUCTIONS RECEIVED FROM QA PERSONNEL AND ACTIONS TAKEN:

JOB SAFETY (INCLUDE MEETINGS HELD AND DEFICIENCIES NOTED WITH  
CORRECTIVE ACTIONS) :

INITIAL INSPECTION:

LIST ALL INSPECTIONS BY SUBJECT AND SPECIFICATION LOCATION.  
COMMENTS AND/OR DEFICIENCIES NOTED AND CORRECTIVE ACTION TAKEN:

FOLLOW-UP INSPECTION:

LIST ALL INSPECTIONS BY SUBJECT AND SPECIFICATION LOCATION.  
COMMENTS AND/OR DEFICIENCIES NOTED AND CORRECTIVE ACTION TAKEN.

SIGNATURE: \_\_\_\_\_  
QUALITY CONTROL REPRESENTATIVE/MANAGER

THE ABOVE REPORT IS COMPLETE AND CORRECT. ALL MATERIALS AND  
EQUIPMENT USED AND ALL WORK PERFORMED DURING THIS REPORTING PERIOD  
ARE IN COMPLIANCE WITH THE CONTRACT SPECIFICATIONS, AND SUBMITTALS,  
EXCEPT AS NOTED ABOVE.

SIGNATURE: \_\_\_\_\_  
CONTRACTOR'S APPROVED AUTHORIZED REPRESENTATIVE

# RECORD DRAWING AS-BUILT XYZ CONTRACTOR

Plate: 1

Sheet  
Number:  
T-1

FT. INDIANTOWN GAP

PENNSYLVANIA

EQUIPMENT CONCENTRATION SITE

COVER SHEET

U.S. ARMY ENGINEER DISTRICT, BALTIMORE  
CORPS OF ENGINEERS  
BALTIMORE, MARYLAND

Designed by:

Date:

JAN 2001

Rev.

Dwn by:

Ckd by:

Design file no.

A/E FIRM/CONTRACTOR  
3 LINES  
PROVIDED OR LOGO

Reviewed by:

Drawing Number:

F-XXX-XX-XX

Submitted by:

File name: FILENAME

Plot date: 12/25/00

Chief, Branch

Plot scale: 1=1

	AS-BUILT	10 SEP 02					
3	REVISED SECTION A-A AND C-C	5 JAN 01	A.E. D.P.				
2	REVISED PER AMENDMENT NO. 2	30 DEC 00	A.E. D.P.				
1	REVISED PER AMENDMENT NO. 1	25 DEC 00	A.E. D.P.				
Mark	Description	Date	Appr.	Mark	Description	Date	Appr.

DIRECTORATE OF PUBLIC WORKS  
ENVIRONMENTAL AND NATURAL RESOURCE DIVISION  
BUILDING 1442, SUITE 200  
FORT BELVOIR, VIRGINIA 22060-5116

## FUEL STORAGE TANK ACTIVITY PERMIT

BLDG/TANK #: \_\_\_\_/\_\_\_\_ DATE PERMIT ISSUED: \_\_\_\_

WORK TO BEGIN: \_\_\_\_ PERMIT EXPIRATION DATE: \_\_\_\_

PERMIT TYPE: \_\_\_\_ INSTALLATION \_\_\_\_ REMOVAL \_\_\_\_ REPAIR/UPGRADE

TANK TYPE: \_\_\_\_ ABOVEGROUND \_\_\_\_ UNDERGROUND

TANK CAPACITY: \_\_\_\_ TANK FUNCTION: \_\_\_\_

SECONDARY CONTAINMENT: \_\_\_\_ YES \_\_\_\_ NO

TANK MATERIAL: \_\_\_\_ STEEL \_\_\_\_ FIBERGLASS \_\_\_\_ PLASTIC  
\_\_\_\_ OTHER: \_\_\_\_\_

\_\_\_\_ SINGLE WALLED \_\_\_\_ DOUBLE WALLED

TANK EXTERIOR COATING: \_\_\_\_ NONE \_\_\_\_ TYPE: \_\_\_\_

PIPING MATERIAL: \_\_\_\_ STEEL \_\_\_\_ COPPER \_\_\_\_ PLASTIC  
\_\_\_\_ OTHER: \_\_\_\_\_

\_\_\_\_ PRESSURIZED \_\_\_\_ SUCTION  
\_\_\_\_ SINGLE WALLED \_\_\_\_ DOUBLE WALLED

PIPE EXTERIOR COATING: \_\_\_\_\_

CATHODIC PROTECTION: \_\_\_\_ NONE \_\_\_\_ SACRIFICIAL \_\_\_\_ IMPRESS

TYPE LEAK DETECTION: \_\_\_\_ AUTOMATIC \_\_\_\_ INTERSTITIAL \_\_\_\_ MANUAL  
OTHER: \_\_\_\_\_

OVERFILL/SPILL PROTECTION: \_\_\_\_\_

FUEL / MATERIAL TO BE STORED IN TANK: \_\_\_\_\_

FIRE EXTINGUISHER \_\_\_\_\_

SAFETY GROUND from TANK \_\_\_\_\_

DRAIN PLUG \_\_\_\_\_

The permit holder is required to inform DPW-ENRD at least 48 hours prior to the excavation, installation, removal, and/or upgrading of any underground or aboveground storage tank (UST or AST) on Fort Belvoir, (703) 806-3694. The DPW-ENRD or its representative must be on site during actual removal and/or final installation of any tank system, and/or the testing of such systems to insure complete compliance to the Commonwealth of Virginia laws and regulations. The permit holder is solely responsible to insure that the Commonwealth of Virginia regulations 9 VAC 25-580-10 and 9 VAC 25-91-10 et. seq. is adhered to during all operations dealing with underground storage tanks and/or aboveground storage tanks. Failure to comply with local, state, and federal regulations and laws may result in legal action being taken against the Contractor responsible.

I acknowledge receipt and agree to comply with the Virginia Regulation 9 VAC 25-580-10 and 9 VAC 25-91-10 et. seq. and all Fort Belvoir regulations regarding my operations with the above noted tank system. I also agree and understand that when there is a conflict with state/federal regulations and the contract drawings or specifications that the state/federal laws and regulations will govern my actions.

ON BEHALF OF \_\_\_\_\_

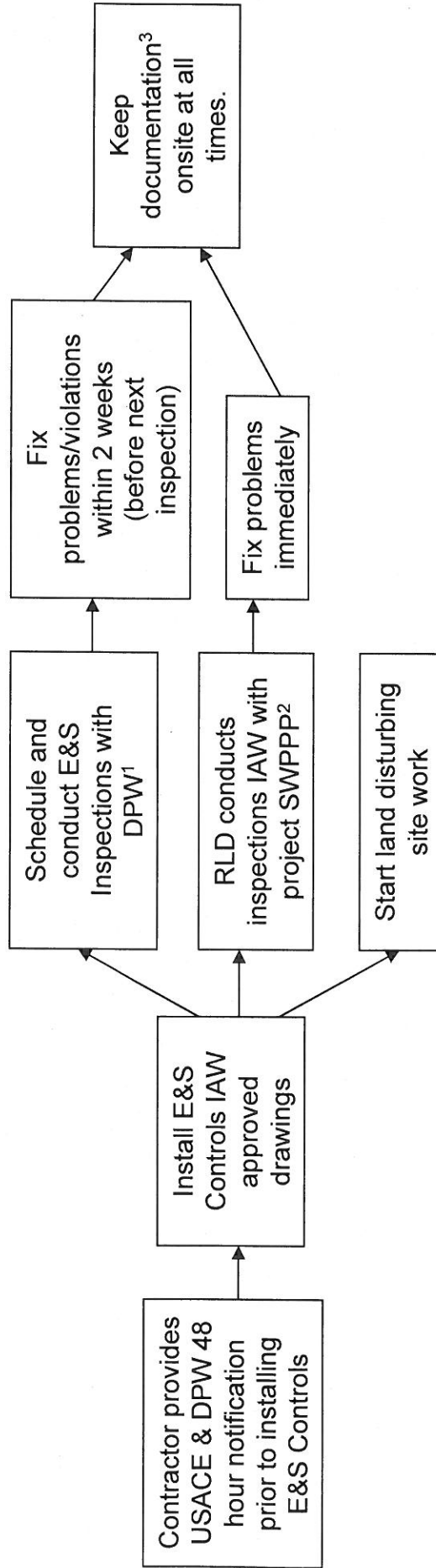
\_\_\_\_\_  
AUTHORIZED SIGNATURE                      PRINTED NAME                      DATE

PERMIT APPROVED AND ISSUED BY:      PERMIT NUMBER: \_\_\_\_\_

\_\_\_\_\_  
AUTHORIZED SIGNATURE                      PRINTED NAME                      DATE

## Appendix NN – Fort Belvoir Erosion and Sediment Control Inspection Process

# Ft. Belvoir Erosion and Sediment Control Inspections



## Notes:

- 1) Inspections with DPW required every 2 weeks and after significant rain event.
- 2) Project specific SWPPP may require inspections daily/weekly or after a significant rain event – check SWPPP for details.
- 3) Documentation includes: inspection reports, SWPPP, E&S plan

## **Appendix OO – Division 01 Supplement Specifications**



PROJECT TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

01 00 00 ADMINISTRATIVE REQUIREMENTS  
01 05 00 JOB CONDITIONS

01 35 29 SAFETY AND OCCUPATIONAL HEALTH REQUIREMENTS

01 57 20 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT FOR DESIGN  
BUILD  
01 57 23.00 10 STORM WATER POLLUTION PREVENTION MEASURES

-- End of Project Table of Contents --

## SECTION 01 00 00

## ADMINISTRATIVE REQUIREMENTS

10/04

## PART 1 GENERAL

## 1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-01 Preconstruction Submittals

## Personnel List

List for emergency notification.

## Photographs

Digital photos of construction progress

## SD-03 Product Data

## Cost or Pricing Data

Proof of actual equipment costs.

## Equipment Data

An itemized list of serial/model numbers and equipment installed by the Contractor under this contract.

## SD-10 Operations and Maintenance Data

## O and M Data

A list of proposed maintenance and instruction manuals that is mainly used for but not limited to customized equipment.

## Commissioning Activity for HVAC; G AR

The Contractor shall provide a separate activity for commissioning. Commissioning shall start only after all HVAC related work has been completed and all HVAC O&M manuals have been submitted and approved by the Government.

## 1.2 PROGRESS SCHEDULING AND REPORTING (DEC 1998)

## 1.2.1 Practicable Progress Schedule

The Contractor shall, within 20 days after date of commencement of work or as otherwise determined by the Contracting Officer, submit for approval a

practicable progress schedule in accordance with specification Section 01 32 01.00 10 PROJECT SCHEDULE showing the manner in which he intends to prosecute the work.

#### 1.2.2 Software Package

The Contractor shall utilize an industry recognized QCS-W compatible scheduling software package to implement the requirements of Section 01 32 01.00 10 PROJECT SCHEDULE. The program and data must be IBM PC compatible in a Window environment. These requirements are not intended to restrict the Contractors selection of an automated scheduling system but to establish a format which will allow use of the same program with government computers and automated information systems. The Contractor will provide at least one program installation and maintenance on government hardware complete with all program and data files. Such installation shall be maintained for the duration of the project until fiscal completion and shall allow analysis and of the project schedule by government personnel or agents. The Contractor will be required to submit a submittal register, transmittal log and schedule that is compatible with the Corps of Engineers Quality Control System for Windows (QCS-W). The submittal register can be made available by the Corps of Engineers.

#### 1.2.3 Additional Scheduling Requirements

The Contractor shall incorporate the following requirements in addition to those specified in Section 01 32 01.00 10 PROJECT SCHEDULE.

#### 1.2.4 Preparation of Operation and Maintenance (O&M) Manuals

The Contractor shall provide a separate activity for the preparation and submission of all O&M manuals. The associated cost of \$3,000 shall be assessed for this activity.

#### 1.2.5 Commissioning Activity for HVAC

The Contractor shall provide a separate activity for commissioning of the HVAC system. The activity shall be as a minimum 15 days long. The associated cost of \$3000 shall be assessed for this activity. Commissioning shall start only after all HVAC related work has been completed and all HVAC O&M manuals have been submitted and approved by the Government.

#### 1.2.6 Additional Commissioning Requirements

Provide separate activities for commissioning of systems shown below. Each activity shall be as a minimum duration as shown below and shall have an appropriate associated cost.

- a. Electrical Interior 5 days in duration at a cost of \$2,000.
- b. Electrical Exterior 5 days in duration at a cost of \$2,000.
- c. Fire Alarm System 5 days in duration at a cost of \$2,000.
- d. Notification/Alert System 5 days in duration at a cost of \$2,000.
- e. Vehicle Exhaust System 5 days in duration at a cost of \$1,000.

## 1.3 PAYMENTS TO CONTRACTORS: (NOV 1976)

For payment purposes only, an allowance will be made by the Contracting Officer of 100 percent of the invoiced cost of materials or equipment delivered to the site but not incorporated into the construction, pursuant to the Contract Clause entitled "PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS". The Contracting Officer may also, at his discretion, take into consideration the cost of materials or equipment stored at locations other than the jobsite, when making progress payments under the contract. In order to be eligible for payment, the Contractor must provide satisfactory evidence that he has acquired title to such material or equipment, and that it will be utilized on the work covered by this contract. Further, all items must be properly stored and protected. Earnings will be computed using 100% of invoiced value. (CENAB-CO-E)

## 1.4 PURCHASE ORDER: (SEP 1975)

One readable copy of all purchase orders for material and equipment, showing firm names and addresses, and all shipping bills, or memoranda of shipment received regarding such material and equipment, shall be furnished the appointed Contracting Officer's Representative as soon as issued. Such orders, shipping bills or memoranda shall be so worded or marked that all material and each item, piece or member of equipment can be definitely identified on the drawings. Where a priority rating is assigned to a contract, this rating, the required delivery date, and the scheduled shipping date shall also be shown on the purchase order. At the option of the Contractor, the copy of the purchase order may or may not indicate the purchase price. (CENAB-CO-E)

## 1.5 EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE (EFARS 52.0231.5000 (OCT 1995))

(a) This clause does not apply to terminations. See 52.249-5000, Basis for settlement of proposals and FAR Part 49.

(b) Allowable cost for construction and marine plant and equipment in sound workable conditions owned or controlled and furnished by a contractor or subcontractor at any tier shall be based on actual costs data for each piece of equipment or groups of similar serial and services for which the government can determine both ownership and operating costs from the contractor's accounting records. When both ownership and operating costs can not be determined for any piece of equipment or groups of similar serial or series equipment from the contractor's accounting records, costs for that equipment shall be based upon the applicable provisions of EP1110-1-8 Construction Equipment Ownership and Operating Expenses Schedule, Region East. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the contracting officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retroactive pricing, the schedule in effect at the time the work was performed shall apply.

(c) Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d) (ii) and Far 31.205-36. Rates for equipment rented from an organization under common control, lease-purchase arrangements, and sale-leaseback arrangements, will be determined using the schedule, except that actual rates will be used for equipment leased from an organization

under common control that has an established proactive of leasing the same or similar equipment to unaffiliated leasees.

(d) When actual equipment costs are proposed and the total amount of the pricing action exceeds the small purchase threshold, the contracting officer shall request the contractor to submit either certified cost or pricing data, or partial/limited data, as appropriate. The data shall be submitted on Standard Form 1411, Contract Pricing Proposal Cover Sheet. CENAB-CT/SEP 95 (EFARS 52.231-5000)

#### 1.6 REAL PROPERTY EQUIPMENT DATA: (APR 1975)

At or before the time of completion of the contract, the Contractor shall submit to the Contracting Officer a complete itemized list, including serial and model number where applicable, showing the unit retail value of each Contractor furnished item of mechanical, electrical and plumbing equipment installed by the Contractor under this contract. For each of the items which is specified herein to be guaranteed for a specified period from the date of acceptance thereof, either for beneficial use or final acceptance, whichever is earlier, against defective materials, design, and workmanship, the following information shall be given: the name, address and telephone number of the Subcontractor, Equipment Supplier, or Manufacturer originating the guaranteed item. The list shall be accompanied by a copy of the specific guarantee document for each item which is specified herein to be guaranteed if one had been furnished to the Contractor by the Equipment Supplier or Manufacturer. The Contractor's guarantee to the Government of these items will not be limited by the terms of any manufacturer's guarantee to the Contractor. Baltimore District NADB Form 1019 may be utilized for the itemized listing and will be made available to the Contractor upon request. (CENAB-CO-E)

#### 1.7 O and M DATA: (JUL 1979)

The requirements for furnishing operating and maintenance data and field instruction are specified elsewhere in the specifications prepared by the Designer of Record. The Contractor shall submit to the Contracting Officer, at a time prior to the 50% project completion time, a list of proposed maintenance and instruction manuals to be furnished the Government and the scheduled dates of all required field instructions to be provided by Contractor furnished personnel or manufacturer's representatives. All maintenance and instruction manuals must be furnished to the Contracting Officer at least 2 weeks prior to the scheduled dates of any required Contractor furnished field instructions or at least one month prior to project completion if no Contractor furnished field instructions are required. (CENAB)

#### 1.8 FACILITY SECURITY REQUIREMENTS:

##### 1.8.1 Identification Cards

Contractor employees who will access Fort Belvoir for a period greater than two weeks duration are required to obtain a Government Civilian Identification Card. Contractor's employees shall complete one copy of EAP Form 1199 for the Civilian ID card application. Properly completed forms will be forwarded to the DES Security Officer for further processing along with a copy of the birth certificate, and for non-citizen civilian ID cards, a valid passport or Naturalization papers. All forms will be reviewed by the COR for completeness. Properly completed forms will be forwarded to the DES Security Officer for further processing along with a

copy of the birth certificate. The Contracting Officer will assist in locating buildings and offices, and obtaining phone numbers under this provision.

#### 1.8.2 Return of Identification Cards

Contractor shall be responsible for the return of all civilian ID cards and security badges for both his and all subcontractor employees immediately upon termination of the employee or when work is completed. Unreturned ID cards and badges will be assessed liquidated damages of \$1000 per item and will be reflected as an unsatisfactory rating item in the Contractor's performance rating.

#### 1.8.3 Vehicle Identification

Official Contractor vehicles identified by company placards or logos, construction trailers, and staging may be located or park in designated areas as shown on the site plan.

#### 1.8.4 Illegal Aliens and Foreign Nationals

No illegal aliens are permitted on the Post. Contractor personnel may include foreign nationals with valid work visa.

#### 1.8.5 Searches

All vehicles and walk-in's are subject to search.

#### 1.8.6 One-Day Subcontractors

One-day subcontractors such as concrete suppliers may obtain a pass on a daily basis.

#### 1.8.7 Vehicle Compliance

Contractor vehicles shall comply with Commonwealth of Virginia Department of Transportation requirements, including tags, vehicle registrations, insurance requirements, vehicle safety, etc.

#### 1.8.8 Vehicle-Troop Encounters

Contractor vehicles shall stop, slow down, or give right-of-way for troop traffic on post roads.

#### 1.9 CONTRACTOR PERSONNEL EMERGENCY LIST

The Contractor shall furnish a list of contact personnel of the Contractor and subcontractors including addresses and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

#### 1.10 SUPERVISION

- a. Provide at least one (1) qualified Project Manager and one (1) on-site Project Superintendent per project capable of reading, writing, and conversing fluently in English. The Project Manager must have a minimum 10 years experience as a Project Manager or Superintendent on projects like this contract or similar in size and complexity. The Project Superintendent must have a minimum of

10 years experience as a Superintendent on projects similar in size and complexity.

- b. The Project Manager in this context shall mean the individual with the responsibility for the overall management of the project and the Project Superintendent shall mean the individual with the responsibility for quality and production. Both the Project Manager and Project Superintendent are subject to removal by the Contracting Officer for non-compliance with requirements specified in the contract and for failure to manage the project to insure timely completion. Furthermore, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time for excess costs or damages by the Contractor.
- c. Approval of Project Manager and on-site Project Superintendent is required prior to start of construction. Provide resumes for the proposed Project Manager and on-site Project Superintendent describing their experience with references and qualifications to the Contracting Officer for approval. The Contracting Officer reserves the right to interview the proposed Project Manager and on-site Project Superintendent at any time in order to verify the submitted qualifications.

#### 1.11 ELECTRONIC MAIL (E-MAIL) ADDRESS

The Contractor shall establish and maintain electronic mail (e-mail) capability along with the capability to open various electronic attachments in Microsoft, Adobe Acrobat, and other similar formats. Within 10 days after contract award, the Contractor shall provide the Contracting Officer a single (only one) e-mail address for electronic communications from the Contracting Officer related to this contract including, but not limited to contract documents, invoice information, request for proposals, and other correspondence. The Contracting Officer may also use email to notify the Contractor of base access conditions when emergency conditions warrant, such as hurricanes, terrorist threats, etc. Multiple email address will not allowed.

It is the Contractor's responsibility to make timely distribution of all Contracting Officer initiated e-mail with its own organization including field office(s). The Contractor shall promptly notify the Contracting Officer, in writing, of any changes to this email address.

#### 1.12 NEGOTIATED MODIFICATIONS: (OCT 84)

Whenever profit is negotiated as an element of price for any modification to this contract with either prime or subcontractor, a reasonable profit shall be negotiated or determined by using the OCE Weighted Guidelines method outlined in EFARS 15.902. (Sugg. NAB 84-232)

#### 1.13 PHOTOGRAPHS

Provide monthly, and within one month of the completion of work, digital photographs in JPEG file format showing the sequence and progress of work. Take a minimum of ten digital photographs prior to the seventh day of each month of views and points located by the Contracting Officer. Submit a view location sketch indicating points of view. Submit with the monthly invoice two sets of digital photographs each set on a separate CD-R,

cumulative of all photos to date. Photographs for each month shall be in a separate monthly directory and each file shall be named to indicate its location on the view location sketch. The view location sketch shall also be provided on the CD as digital file. All file names shall include a date designator. (CENAB-EN)



#### 1.15 PERMITS

The contractor shall obtain all permits unless otherwise specified elsewhere.

#### PART 2 PRODUCTS

NOT APPLICABLE

#### PART 3 EXECUTION

NOT APPLICABLE

-- End of Section --



## SECTION 01 05 00

JOB CONDITIONS  
08/04

## PART 1 GENERAL

## 1.1 LAYOUT OF WORK

LAYOUT OF WORK: (APR 1984) The Contractor shall lay out his work and shall be held responsible for all measurement's in connection therewith. The Contractor shall furnish, at his own expense, all stakes, templates, platforms, equipment, tools, and materials and labor as may be required in laying out any part of the work. The Contractor will be held responsible for the execution of the work to such lines and grades as may be established or indicated by the Contracting Officer. It shall be the responsibility of the Contractor to maintain and preserve all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed, by the Contractor or through his negligence, prior to their authorized removal, they may be replaced by the Contracting Officer at his discretion. The expense of replacement will be deducted from any amounts due or to become due the Contractor. (CENAB)

## 1.2 PHYSICAL DATA: (APR 1984)

Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation or conclusion drawn from the data or information by the Contractor. (CENAB)

## 1.2.1 Transportation Facilities

Highway Network: The principal access routes to Fort Belvoir are I-95 from the north and south, and State Highway 617 (Backlick Road) from the north.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-01 Preconstruction Submittals

Shut Down Utility Services; G AR.

Prior approval for service/utility interruptions.

Checklist; G AR

A Risk Assessment for excavation and other work in the vicinity of utilities.

## SD-07 Certificates

## Operations Statement

Written proof that the boilers have been properly installed and are operating satisfactorily in accordance with the manufacturer's instructions.

## 1.4 UTILITIES

## 1.4.1 Availability of Utilities Including Lavatory Facilities: (JUN 1980)

It shall be the responsibility of the Contractor to provide all utilities he may require during the entire life of the contract. He shall make his own investigation and determinations as to the availability and adequacy of utilities for his use for construction purposes and domestic consumption. He shall install and maintain all necessary supply lines, connections, piping, and meters if required, but only at such locations and in such manner as approved by the Contracting Officer. Before final acceptance of work under this contract, all temporary supply lines, connections and piping installed by the Contractor shall be removed by him in a manner satisfactory to the Contracting Officer. (CENAB)

## 1.4.2 Interruption of Utilities: (1972)

a. No utility services shall be interrupted by the Contractor to make connections, to relocate, or for any purpose without approval of the Contracting Officer.

b. Request for permission to shut down utility services shall be submitted in writing to the Contracting Officer not less than 17 days prior to proposed date of interruption. The request shall give the following information:

c. Nature of Utility (Gas, L.P. or H.P., Water, Etc.)

d. Size of line and location of shutoff.

e. Buildings and services affected.

f. Hours and date of shutoff.

g. Estimated length of time service will be interrupted.

h. Services will not be shut off until receipt of approval of the proposed hours and date from the Contracting Officer.

i. Shutoffs which will cause interruption of Government work operations as determined by the Contracting Officer shall be accomplished during regular non-work hours or on non-work days of the Using Agency without any additional cost to the Government.

j. Operation of valves on water mains will be by Government personnel. Where shutoff of water lines interrupts service to fire hydrants or fire sprinkler systems, the Contractor shall arrange his operations and have sufficient material and personnel available to complete the work without undue delay or to restore service without delay in event of emergency.

k. Flow in gas mains which have been shut off shall not be restored until the Government inspector has determined that all items serviced by the gas line have been shut off. (CENAB)

## 1.4.3 Utility Markings

The Contractor shall contact the installation/DPW and the One-Call Service, a minimum of 14 days and 48 hours, respectively, prior to any excavation, the Post DPW and Miss Utility requesting utility location markings. The Contractor shall not proceed with any excavation until all utilities, including abandoned utilities, have been marked to the satisfaction of the Contracting Officer. Prior to requesting the marking of utilities, the Contractor shall stake out proposed excavations and limits of work with white lines ("White Lining"). It is the Contractor's responsibility to ensure that all permits (excavation or otherwise, including DPW permits) are current and up-to-date without expiration. In addition to the above requirements the Contractor shall:

- a) Visually survey and verify that all utility markings are consistent with existing appurtenances such as manholes, valve boxes, poles, pedestals, pad-mounted devices, gas meters, etc. prior to any excavation.
- b) Hand dig test holes to verify the depth and location of all utilities prior to any mechanical excavation within the limits of work. Other non-damaging methods for utility verification, as indicated in (d) below, may be considered subject to approval by the Contracting Officer. Also, verify that any abandoned utilities are not active.
- c) Preserve all utility markings for the duration of the project to the furthest extent possible.
- d) When excavation is performed within 2 feet of any utility line, a non-damaging method of excavation shall be used. The non-damaging method shall be hand digging. Other non-damaging methods, such as, soft digging, vacuum excavation, pneumatic hand tools, may be considered subject to approval by the Contracting Officer.
- e) Regardless of the type of excavation, the Contractor shall notify the Contracting Officer a minimum of 72 hours prior to any excavation activity. Failure to notify the Contracting Officer can result in the issuance of a "Stop Work" order, which shall not be justification for contract delay or time extension. The Government reserves the right to have personnel present on site during any type of excavation.
- f) The Contractor's Quality Control System Manager shall ensure that all excavation requirements herein are met at the time of the preparatory phase of quality control, and that the excavation procedures are reviewed during the preparatory phase meeting. This preparatory phase of control shall also establish and document contingency plans and actions to be followed in the event that existing utilities are damaged or interrupted. Locations of shut off or isolation devices along with other safety features shall be established and their operation reviewed.
- g) Any work other than excavation in the vicinity of a utility, that could damage or interrupt a utility, such as, exterior or interior work near transformers, power lines, poles, above ground gas lines, gas meters, etc., shall be done with extreme care. The Contractor shall specifically note during the preparatory phase of

quality control, the construction techniques to be used to preclude damaging or interrupting any utility. This preparatory phase of control shall also establish and document contingency plans and actions to be followed in the event that existing utilities are damaged or interrupted. Locations of shut off or isolation devices along with other safety features shall be established and their operation reviewed.

- h) The Contractor shall complete a risk assessment, using the attached checklist, at least one week prior to the start of any excavation or other work in the vicinity of a utility. The risk assessment shall be submitted for government approval prior to any excavation or other work in the vicinity of a utility. A risk assessment shall be completed for each definable feature of work encountering utilities and shall include all utilities anticipated to be encountered.

#### 1.5 DISPOSAL OF EXISTING MATERIAL AND EQUIPMENT: (DEC 1975)

All removed, dismantled or demolished material and/or equipment including rubble, scrap and debris not specified or indicated to be Government salvaged, reinstalled under this contract or otherwise retained for disposal on Government land will become the property of the Contractor and shall be promptly removed from the site and properly disposed of by the Contractor at his own expense and responsibility. (CENAB)

#### 1.6 COMPLIANCE WITH POST/BASE REGULATIONS: (JUL 1980)

The site of the work is on a military reservation and all rules and regulations issued by the Commanding Officer covering general safety, security, sanitary requirements, pollution control, traffic regulations and parking, shall be observed by the Contractor. Information regarding these requirements may be obtained by contacting the Contracting Officer, who will provide such information or assist in obtaining same from appropriate authorities. (MEMO)

#### 1.7 MAINTENANCE OF ACCESS: (DEC 1975)

The Contractor shall not block passage through sidewalks, roads, alleys or other entranceways to adjacent buildings during performance of work under this contract. (CENAB)

#### 1.8 PROTECTION OF GOVERNMENT PROPERTY AND PERSONNEL: (DEC 1975)

##### 1.8.1 Protection of Equipment

All existing Government owned equipment within the work area shall be protected by the Contractor from damage caused by construction operations. As a minimum, the Contractor shall cover all equipment in the work area with dust barriers and protect such items from any damage due to dust, vibration, water, heat or other conditions resulting from construction activities. Existing work damaged by construction operations shall be promptly repaired by the Contractor at his own expense.

##### 1.8.2 Protection of Personnel

The Contractor shall protect personnel by installing safety rails and/or barricades as applicable to prevent injury from unauthorized entry into work areas. Warning signs shall be erected as necessary to indicate

Construction areas or hazardous zones. Work shall proceed in such manner as to prevent the undue spread of dust and flying particles.

#### 1.8.3 Measures to Prevent Damage/Injury

The Contractor shall take such additional measures as may be directed by the Contracting Officer to prevent damage or injury to Government property or personnel. (CENAB)

#### 1.9 STREET CLOSINGS: (MAY 1978)

When operations in connection with contract work necessitate the closing of streets, it shall be the Contractor's responsibility to arrange in advance with the Contracting Officer for such street closings and to provide appropriate barricades, signs, markers, flares, and other devices as may be required by the Contracting Officer's Representative for traffic guides and public safety. (CENAB)

#### 1.10 CONTRACTOR USE OF HEATING PLANT: (1968) (MOD 1975)

##### 1.10.1 Utilization of the Installed Heating System

The Contractor may, at his option, utilize the heating system installed under this contract to provide space heating prior to the time of completion of the building. All fuel-oil for such space heating and for the required tests of heating equipment shall be furnished by the Contractor and shall be of the type and grade specified.

##### 1.10.2 Operations Statement

The heating system shall be operated only by qualified personnel and shall be operated with all auxiliaries and in accordance with the manufacturer's instructions and good operating practice. Boilers shall not be operated for space heating until the Contracting Officer is furnished a written operations statement signed by the Contractor certifying that all water treating equipment, combustion control equipment, and the boiler safety controls have been properly installed and are operating satisfactorily. When a boiler is to be shut down for a period of more than 5 days, the combustion chamber and the fire sides of all boiler tubes shall be cleaned thoroughly immediately after shutdown. If at any time the Contracting Officer determines that the equipment is being improperly operated or maintained, the Contractor may be directed to discontinue its use.

##### 1.10.3 Controlled Temperature

Heating systems shall be operated and controlled to prevent temperature in any room or space in the building from exceeding 90 degrees F

##### 1.10.4 Renovating the New Heating System

The Contractor shall, prior to the time of final acceptance of all work under this contract, place the heating system and related equipment in a condition equal to new. The combustion chamber and fire side of all boiler tubes shall be cleaned, burner nozzles shall be cleaned and adjusted, and air filters, and pipeline strainers shall be replaced or cleaned, as required. (CENAB)

## 1.11 MAINTENANCE OF UTILITIES: (FEB 1985)

Throughout construction, the Contractor shall provide and/or maintain toilet facilities for Government personnel. The Contractor shall provide alternate space heating for Government personnel when necessary during shutdown of the heating system. (CENAB)

## 1.12 ASBESTOS HANDLING AND REMOVAL (FEB 85)

Through site investigations, friable asbestos has not been found, however if asbestos is encountered, its testing, removal and disposal is covered in "CHANGES" clause of the Contract Clauses. (CENAB)

## 1.13 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER

## 1.13.1 Procedure for Determination

This provision specifies the procedure for determination of time extensions for unusually severe weather in accordance the contract clause entitled "Default: (Fixed Price Construction)". In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

- a. The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.
- b. The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the contractor.

## 1.13.2 Anticipated Adverse Weather Delays

The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY  
WORK DAYS BASED ON (5) DAY WORK WEEK

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
6	6	6	8	6	6	7	5	3	5	5	5

## 1.13.3 Impact

Upon acknowledgment of the Notice to Proceed (NTP) and continuing throughout the contract, the contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the contractor's scheduled work day. The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph "Anticipated Adverse Weather Delays", above, the Contracting

Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a contract modification.

#### 1.14 WORKING HOURS

WORKING HOURS: (SEP 2003) Regular working hours shall consist of an 8 1/2 hour period, between 7:00 a.m. and 3:30 p.m., Monday through Friday, and 7:00 a.m. to 1:00 p.m. on Saturday, excluding Government holidays.

##### 1.14.1 Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval. Make application 10 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress, giving the specific dates, hours, location, type of work to be performed, contract number and project title. Based on the justification provided, the Contracting Officer may approve work outside regular hours. During periods of darkness, the different parts of the work shall be lighted in a manner approved by the Contracting Officer.

#### PART 2 PRODUCTS

NOT APPLICABLE

#### PART 3 EXECUTION

NOT APPLICABLE

ATTACHMENT

RISK ASSESSMENT CHECKLIST

-- End of Section --

# RISK ASSESSMENT FOR EXCAVATION AND OTHER WORK IN THE VICINITY OF UTILITIES

PROJECT NAME: \_\_\_\_\_  
 CONTRACT NUMBER: \_\_\_\_\_  
 PROJECT INSTALLATION AND LOCATION: \_\_\_\_\_  
 PROPOSED EXCAVATION START DATE: \_\_\_\_\_

1. ☐ ESTABLISH EXCAVATION DETAILS AND DRAWINGS (check when completed)
2. ☐ PROPOSED EXCAVATION AREA MARKED ("white lining") (check when completed)
3. ☐ CONTACT APPROPRIATE ONE-CALL SERVICE FOR PUBLIC UTILITIES:  
 MD: Miss Utility 1-800-257-7777      N Y : New York City - Long Island One Call Center 1-800-272-4480  
 N. VA: Miss Utility 1-800-552-7777      PA: Pennsylvania One-Call System Incorporated 1-800-242-1776  
 VA: Miss Utility of VA 1-800-552-7001      DC: Miss Utility 1-800-257-7777  
 ONE-CALL NATIONAL REFERRAL CENTER: 1-888-258-0808
- ☐ CONTACT INSTALLATION/OWNERS OF ALL PRIVATELY OWNED UTILITIES (NON ONE-CALL MEMBERS)
4. ☐ DATE UTILITIES MARKED AND METHOD OF MARKING  
 ONE-CALL LOCATORS \_\_\_\_\_  
 OTHER LOCATORS \_\_\_\_\_
5. ☐ CONTACT APPROPRIATE DPW REPRESENTATIVES AND COMPLY WITH INSTALLATION PERMIT REQUIREMENTS: \_\_\_\_\_
6. ☐ UTILITIES IDENTIFIED ON-SITE:  
☐ NONE ☐ ELECTRIC ☐ GAS ☐ WATER ☐ TELEPHONE ☐ CATV ☐ SEWER ☐ OTHER \_\_\_\_\_
7. ☐ LEVEL OF RISK: (Based upon personnel safety and consequences of utility outages.)  
☐ SEVERE: Excavation required within the immediate vicinity (<2-ft) of a MARKED utility.  
☐ MODERATE: Excav. required outside the immediate vicinity (> 2-ft) of MARKED utility.  
☐ MINIMAL: Excavation required in an area with NO utilities.
8. ☐ EXISTING FACILITIES/UTILITIES IN VICINITY:  
☐ NON-CRITICAL ☐ MISSION CRITICAL ☐ HIGH-PROFILE ☐ CEREMONIAL  
☐ OTHER \_\_\_\_\_  
☐ CONSEQUENCES IF EXISTING UTILITIES ARE DAMAGED/DISRUPTED \_\_\_\_\_
9. ☐ ENGINEERING CONTROLS REQUIRED:  
☐ NONE ☐ HAND EXCAVATE TO LOCATE UTILITY ☐ EXCAVATE WITH DUE CARE  
☐ OTHER \_\_\_\_\_
10. ☐ ADMINISTRATIVE CONTROLS REQUIRED:  
☐ Notification of Contracting Officer's Representative, NOTIFIED on: \_\_\_\_\_  
☐ Notification of Installation/DPW Representative, NOTIFIED on: \_\_\_\_\_
11. ☐ EMERGENCY NOTIFICATION AT INSTALLATION: POC & PHONE NUMBER \_\_\_\_\_

THE INFORMATION NOTED ABOVE IS ACCURATE AND THE WORK IS READY TO PROCEED  
 SIGNED and DATE \_\_\_\_\_ CQC MANAGER

12. ☐ ON-SITE GOVERNMENT REP. RECOMMENDATION FOR APPROVAL TO EXCAVATE:  
☐ YES ☐ NO SIGNATURE AND DATE: \_\_\_\_\_  
 Comments: \_\_\_\_\_
13. ☐ AREA ENGINEER APPROVAL TO EXCAVATE:  
☐ APPROVED ☐ DENIED SIGNATURE AND DATE: \_\_\_\_\_  
 Comments: \_\_\_\_\_
14. ☐ CHIEF, \_\_\_\_\_ DIVISION APPROVAL TO EXCAVATE:  
☐ APPROVED ☐ DENIED SIGNATURE AND DATE: \_\_\_\_\_  
 Comments: \_\_\_\_\_



## SECTION 01 35 29

## SAFETY AND OCCUPATIONAL HEALTH REQUIREMENTS

04/06

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- |                  |  |
|------------------|--|
| ANSI A10.32      | Personal Fall Protection - Safety Requirements for Construction and Demolition Operations      |
| ANSI Z359.1      | (1992; R 1999) Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components |
| ANSI/ASSE A10.34 | (2001) Protection of the Public on or Adjacent to Construction Sites                           |

## ASME INTERNATIONAL (ASME)

- |             |  |
|-------------|--|
| ASME B30.22 | (2005) Articulating Boom Cranes              |
| ASME B30.3  | (1996) Construction Tower Cranes             |
| ASME B30.5  | (2004) Mobile and Locomotive Cranes          |
| ASME B30.8  | (2004) Floating Cranes and Floating Derricks |

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- |          |  |
|----------|--|
| NFPA 10  | (2002) Portable Fire Extinguishers                                 |
| NFPA 51B | (2003) Fire Prevention During Welding, Cutting, and Other Hot Work |
| NFPA 70  | (2005) National Electrical Code                                    |
| NFPA 70E | (2004) Electrical Safety in the Workplace                          |

## U.S. ARMY CORPS OF ENGINEERS (USACE)

- |            |   |
|------------|---|
| EM 385-1-1 | (2008) Safety -- Safety and Health Requirements |
|------------|---|

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

- |                 |                                   |
|-----------------|-----------------------------------|
| 29 CFR 1910.146 | Permit-required Confined Spaces   |
| 29 CFR 1926     | Safety and Health Regulations for |

## Construction

29 CFR 1926.500

Fall Protection

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-01 Preconstruction Submittals

Accident Prevention Plan (APP); G, AR

Activity Hazard Analysis (AHA); G, AR

Crane Critical Lift Plan; G, AR

Proof of qualification for Crane Operators; G, AR

## SD-06 Test Reports

## Reports

Submit reports as their incidence occurs, in accordance with the requirements of the paragraph entitled, "Reports."

Accident Reports

Monthly Exposure Reports

Crane Reports

Regulatory Citations and Violations

## SD-07 Certificates

Confined Space Entry Permit

Hot work permit

Certificate of Compliance (Crane)

Submit one copy of each permit/certificate attached to each Daily Quality Control Report.

## 1.3 DEFINITIONS

a. High Visibility Accident. Any mishap which may generate publicity and/or high visibility.

b. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

c. Recordable Injuries or Illnesses. Any work-related injury or

illness that results in:

- (1) Death, regardless of the time between the injury and death, or the length of the illness;
- (2) Days away from work (any time lost after day of injury/illness onset);
- (3) Restricted work;
- (4) Transfer to another job;
- (5) Medical treatment beyond first aid;
- (6) Loss of consciousness; or
- (7) A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.

d. "USACE" property and equipment specified in USACE EM 385-1-1 should be interpreted as Government property and equipment.

e. Weight Handling Equipment (WHE) Accident. A WHE accident occurs when any one or more of the six elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; and/or collision, including unplanned contact between the load, crane, and/or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, roll over, etc.).

#### 1.4 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this contract, work performed shall comply with USACE EM 385-1-1, and the following federal, state, and local laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply.

#### 1.5 SITE QUALIFICATIONS, DUTIES AND MEETINGS

##### 1.5.1 Personnel Qualifications

##### 1.5.1.1 Site Safety and Health Officer (SSHO)

Site Safety and Health Officer (SSHO) shall be provided at the work site at all times to perform safety and occupational health management, surveillance, inspections, and safety enforcement for the Contractor. The Contractor Quality Control (QC) person cannot be the SSHO on this project, even though the QC has safety inspection responsibilities as part of the QC

duties. The SSHO shall meet the following requirements:

Level 3:

A minimum of 5 years safety work on similar projects.  
30-hour OSHA construction safety class or equivalent within the last 5 years.  
An average of at least 24 hours of formal safety training each year for the past 5 years.  
Competent person training as needed.]

1.5.1.2 Certified Safety Trained Supervisor (STS) and/or Construction Health and Safety Technician (CHST)

Provide a Certified Safety Trained Supervisor (STS) and/or Construction Health & Safety Technician (CHST) at the work site to perform safety management, surveillance, inspections, and safety enforcement for the Contractor. The STS and/or CHST shall be the safety and occupational health "competent person" as defined by USACE EM 385-1-1. The STS and/or CHST shall be at the work site at all times whenever work or testing is being performed and shall conduct and document daily safety inspections. The STS and/or CHST shall have no other duties other than safety and occupational health management, inspections, and enforcement on this contract.

1.5.1.3 Crane Operators

Crane operators shall meet the requirements in USACE EM 385-1-1, Section 16 and Appendix G. In addition, for mobile cranes with Original Equipment Manufacturer (OEM) rated capacities of 50,000 pounds or greater, crane operators shall be designated as qualified by a source that qualifies crane operators (i.e., union, a government agency, or an organization that tests and qualifies crane operators). Proof of current qualification shall be provided.

1.5.2 Personnel Duties

1.5.2.1 Site Safety and Health Officer (SSHO)/Superintendent

- a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Safety inspection logs shall be attached to the Contractors' daily control report.
- b. Conduct mishap investigations and complete required reports. Maintain the OSHA Form 300 and Daily Production reports for prime and sub-contractors.
- c. Maintain applicable safety reference material on the job site.
- d. Attend the pre-construction conference, pre-work meetings including preparatory inspection meeting, and periodic in-progress meetings.
- e. Implement and enforce accepted APPS and AHAs.
- f. Maintain a safety and health deficiency tracking system that monitors outstanding deficiencies until resolution. A list of unresolved safety and health deficiencies shall be posted on the safety

bulletin board.

- g. Ensure sub-contractor compliance with safety and health requirements.

Failure to perform the above duties will result in dismissal of the superintendent and/or SSHO, and a project work stoppage. The project work stoppage will remain in effect pending approval of a suitable replacement.

### 1.5.3 Meetings

#### 1.5.3.1 Preconstruction Conference

a. Contractor representatives who have a responsibility or significant role in accident prevention on the project shall attend the preconstruction conference. This includes the project superintendent, site safety and health officer, quality control supervisor, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).

b. The Contractor shall discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, a schedule for the preparation, submittal, review, and acceptance of AHAs shall be established to preclude project delays.

c. Deficiencies in the submitted APP will be brought to the attention of the Contractor at the preconstruction conference, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Work shall not begin until there is an accepted APP.

d. The functions of a Preconstruction conference may take place at the Post-Award Kickoff meeting for Design Build Contracts.

### 1.6 ACCIDENT PREVENTION PLAN (APP)

The Contractor shall use a qualified person to prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of USACE EM 385-1-1 and as supplemented herein. Cover all paragraph and subparagraph elements in USACE EM 385-1-1, Appendix A, "Minimum Basic Outline for Accident Prevention Plan". Specific requirements for some of the APP elements are described below. The APP shall be job-specific and shall address any unusual or unique aspects of the project or activity for which it is written. The APP shall interface with the Contractor's overall safety and health program. Any portions of the Contractor's overall safety and health program referenced in the APP shall be included in the applicable APP element and made site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention

responsibilities are being carried out. The APP shall be signed by the person and firm (senior person) preparing the APP, the Contractor, the on-site superintendent, the designated site safety and health officer and any designated CSP and/or CIH.

Submit the APP to the Contracting Officer 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.

Once accepted by the Contracting Officer, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.

Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer, project superintendent, SSHO and quality control manager. Should any hazard become evident, stop work in the area, secure the area, and develop a plan to remove the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate/remove the hazard. In the interim, all necessary action shall be taken to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ANSI/ASSE A10.34,) and the environment.

Copies of the accepted plan will be maintained at the Contracting Officer's office and at the job site. The APP shall be continuously reviewed and amended, as necessary, throughout the life of the contract. Unusual or high-hazard activities not identified in the original APP shall be incorporated in the plan as they are discovered.

#### 1.6.1 EM 385-1-1 Contents

In addition to the requirements outlines in Appendix A of USACE EM 385-1-1, the following is required:

a. Crane Critical Lift Plan. Prepare and sign weight handling critical lift plans for lifts over 75 percent of the capacity of the crane or hoist (or lifts over 50 percent of the capacity of a barge mounted mobile crane's hoists) at any radius of lift; lifts involving more than one crane or hoist; lifts of personnel; and lifts involving non-routine rigging or operation, sensitive equipment, or unusual safety risks. The plan shall be submitted 15 calendar days prior to on-site work and include the requirements of USACE EM 385-1-1, paragraph 16.C.18. and the following:

(1) For lifts of personnel, the plan shall demonstrate compliance with the requirements of 29 CFR 1926.550(g).

(2) For barge mounted mobile cranes, barge stability calculations identifying barge list and trim based on anticipated loading; and load charts based on calculated list and trim. The amount of list and trim shall be within the crane manufacturer's requirements.

#### 1.7 ACTIVITY HAZARD ANALYSIS (AHA)

The Activity Hazard Analysis (AHA) format shall be in accordance with USACE EM 385-1-1. Submit the AHA for review at least 15 calendar days prior to the start of each phase. Format subsequent AHAs as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.

The activity hazard analyses shall be developed using the project schedule as the basis for the activities performed. Any activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier or subcontractor and provided to the prime contractor for submittal to the Contracting Officer.

#### 1.8 DISPLAY OF SAFETY INFORMATION

Within 1 calendar day after commencement of work, erect a safety bulletin board at the job site. The safety bulletin board shall include information and be maintained as required by EM 385-1-1, section 01.A.06. Additional items required to be posted include:

- a. Confined space entry permit.
- b. Hot work permit.

#### 1.9 SITE SAFETY REFERENCE MATERIALS

Maintain safety-related references applicable to the project, including those listed in the article "References." Maintain applicable equipment manufacturer's manuals.

#### 1.10 EMERGENCY MEDICAL TREATMENT

Contractors will arrange for their own emergency medical treatment. Government has no responsibility to provide emergency medical treatment.

#### 1.11 REPORTS

##### 1.11.1 Accident Reports

- a. For recordable injuries and illnesses, and property damage accidents resulting in at least \$2,000 in damages, the Prime Contractor shall conduct an accident investigation to establish the root cause(s) of the accident, complete the USACE Accident Report Form 3394 and provide the report to the Contracting Officer within 5 calendar days of the accident. The Contracting Officer will provide copies of any required or special forms.
- b. For any weight handling equipment accident (including rigging gear accidents) the Prime Contractor shall conduct an accident investigation to establish the root cause(s) of the accident, complete the WHE Accident Report (Crane and Rigging Gear) form and provide the report to the Contracting Officer within 30 calendar days of the accident. Crane operations shall not proceed until cause is determined and corrective

actions have been implemented to the satisfaction of the contracting officer. The Contracting Officer will provide a blank copy of the accident report form.

#### 1.11.2 Accident Notification

Notify the Contracting Officer as soon as practical, but not later than four hours, after any accident meeting the definition of Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than \$2,000, or any weight handling equipment accident. Information shall include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on-site and Government investigation is conducted.

#### 1.11.3 Monthly Exposure Reports

Monthly exposure reporting to the Contracting Officer is required to be attached to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both prime and subcontractor. The Contracting Officer will provide copies of any special forms.

#### 1.11.4 Crane Reports

Submit crane inspection reports required in accordance with USACE EM 385-1-1, Appendix H and as specified herein with Daily Reports of Inspections.

#### 1.11.5 Certificate of Compliance

The Contractor shall provide a Certificate of Compliance for each crane entering an activity under this contract (see Contracting Officer for a blank certificate). Certificate shall state that the crane and rigging gear meet applicable OSHA regulations (with the Contractor citing which OSHA regulations are applicable, e.g., cranes used in construction, demolition, or maintenance shall comply with 29 CFR 1926 and USACE EM 385-1-1 section 16 and Appendix H. Certify on the Certificate of Compliance that the crane operator(s) is qualified and trained in the operation of the crane to be used. The Contractor shall also certify that all of its crane operators working on the DOD activity have been trained in the proper use of all safety devices (e.g., anti-two block devices). These certifications shall be posted on the crane.

#### 1.12 HOT WORK

Prior to performing "Hot Work" (welding, cutting, etc.) or operating other flame-producing/spark producing devices, a written permit shall be requested from the Using Agency through the Contracting Officer. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. The Contractor will provide at least two (2) twenty (20) pound 4A:20 BC rated extinguishers for normal "Hot Work". All extinguishers shall be current inspection tagged, approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity. The Fire Watch shall be trained in accordance with NFPA 51B and remain on-site for a minimum of 30 minutes after completion of



the task or as specified on the hot work permit.

When starting work in the facility, Contractors shall require their personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency Fire Department phone number. ANY FIRE, NO MATTER HOW SMALL, SHALL BE REPORTED TO THE RESPONSIBLE FIRE DEPARTMENT AND THE CONTRACTING OFFICER IMMEDIATELY.

## PART 2 PRODUCTS

Not used.

## PART 3 EXECUTION

### 3.1 PRE-OUTAGE COORDINATION MEETING

Contractors are required to apply for utility outages per guidance in Section 01 05 00 JOB CONDITIONS. As a minimum, the request should include the location of the outage, utilities being affected, duration of outage and any necessary sketches. Special requirements for electrical outage requests are contained elsewhere in this specification section. Once approved, and prior to beginning work on the utility system requiring shut down, the Contractor shall attend a pre-outage coordination meeting with the Contracting Officer and the Using Agency representative to review the scope of work and the lock-out/tag-out procedures for worker protection. No work will be performed on energized electrical circuits unless proof is provided that no other means exist.

### 3.2 FALL HAZARD PROTECTION AND PREVENTION PROGRAM

The Contractor shall establish a fall protection and prevention program, for the protection of all employees exposed to fall hazards. The program shall include company policy, identify responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and evacuation procedures.

#### 3.2.1 Training

The Contractor shall institute a fall protection training program. As part of the Fall Hazard Protection and Prevention Program, the Contractor shall provide training for each employee who might be exposed to fall hazards. A competent person for fall protection shall provide the training. Training requirements shall be in accordance with USACE EM 385-1-1, section 21.A.16.

#### 3.2.2 Fall Protection Equipment and Systems

The Contractor shall enforce use of the fall protection equipment and systems designated for each specific work activity in the Fall Protection and Prevention Plan and/or AHA at all times when an employee is exposed to a fall hazard. Employees shall be protected from fall hazards as specified in EM 385-1-1, section 21. In addition to the required fall protection systems, safety skiff, personal floatation devices, life rings etc., are required when working above or next to water in accordance with USACE EM 385-1-1, paragraphs 05.H. and 05.I. Personal fall arrest systems are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall arrest systems are required when operating other equipment such as scissor lifts if the work platform is capable of being positioned outside the wheelbase. The

need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, or travel. Fall protection must comply with 29 CFR 1926.500, Subpart M, USACE EM 385-1-1 and ANSI A10.32.

#### 3.2.2.1 Personal Fall Arrest Equipment

Personal fall arrest equipment, systems, subsystems, and components shall meet ANSI Z359.1. Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. Body belts may only be used as a positioning device system (for uses such as steel reinforcing assembly and in addition to an approved fall arrest system). Harnesses shall have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Only locking snap hooks and carabiners shall be used. Webbing, straps, and ropes shall be made of synthetic fiber. The maximum free fall distance when using fall arrest equipment shall not exceed 1.8 m (6 feet). The total fall distance and any swinging of the worker (pendulum-like motion) that can occur during a fall shall always be taken into consideration when attaching a person to a fall arrest system.

#### 3.2.3 Fall Protection for Roofing Work

Fall protection controls shall be implemented based on the type of roof being constructed and work being performed. The roof area to be accessed shall be evaluated for its structural integrity including weight-bearing capabilities for the projected loading.

##### a. Low Sloped Roofs:

(1) For work within 1.8 m (6 feet) of an edge, on low-slope roofs, personnel shall be protected from falling by use of personal fall arrest systems, guardrails, or safety nets.

(2) For work greater than 1.8 m (6 feet) from an edge, warning lines shall be erected and installed in accordance with 29 CFR 1926.500 and USACE EM 385-1-1.

b. Steep-Sloped Roofs: Work on steep-sloped roofs requires a personal fall arrest system, guardrails with toe-boards, or safety nets. This requirement also includes residential or housing type construction.

#### 3.2.4 Existing Anchorage

Existing anchorages, to be used for attachment of personal fall arrest equipment, shall be certified (or re-certified) by a qualified person for fall protection in accordance with ANSI Z359.1. Existing horizontal lifeline anchorages shall be certified (or re-certified) by a registered professional engineer with experience in designing horizontal lifeline systems.

#### 3.2.5 Horizontal Lifelines

Horizontal lifelines shall be designed, installed, certified and used under the supervision of a qualified person for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (29 CFR 1926.500).

### 3.2.6 Guardrails and Safety Nets

Guardrails and safety nets shall be designed, installed and used in accordance with EM 385-1-1 and 29 CFR 1926 Subpart M.

### 3.2.7 Rescue and Evacuation Procedures

When personal fall arrest systems are used, the contractor must ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. A Rescue and Evacuation Plan shall be prepared by the contractor and include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. The Rescue and Evacuation Plan shall be included in the Activity Hazard Analysis (AHA) for the phase of work, in the Fall Protection and Prevention (FP&P) Plan, and the Accident Prevention Plan (APP).

## 3.3 EQUIPMENT

### 3.3.1 Material Handling Equipment

a. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions.

b. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions.

c. Operators of forklifts or power industrial trucks shall be licensed in accordance with OSHA.

### 3.3.2 Weight Handling Equipment

a. Cranes and derricks shall be equipped as specified in EM 385-1-1, section 16.

b. The Contractor shall comply with the crane manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Erection shall be performed under the supervision of a designated person (as defined in ASME B30.5). All testing shall be performed in accordance with the manufacturer's recommended procedures.

c. The Contractor shall comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.3 for construction tower cranes, and ASME B30.8 for floating cranes and floating derricks.

d. Under no circumstance shall a Contractor make a lift at or above 90% of the cranes rated capacity in any configuration.

e. When operating in the vicinity of overhead transmission lines, operators and riggers shall be alert to this special hazard and shall follow the requirements of USACE EM 385-1-1 section 11 and ASME B30.5 or ASME B30.22 as applicable.

f. Crane suspended personnel work platforms (baskets) shall not be

used unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Personnel shall not be lifted with a line hoist or friction crane.

g. Portable fire extinguishers shall be inspected, maintained, and recharged as specified in NFPA 10, Standard for Portable Fire Extinguishers.

h. All employees shall be kept clear of loads about to be lifted and of suspended loads.

i. The Contractor shall use cribbing when performing lifts on outriggers.

j. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.

k. A physical barricade must be positioned to prevent personnel from entering the counterweight swing (tail swing) area of the crane.

l. Certification records which include the date of inspection, signature of the person performing the inspection, and the serial number or other identifier of the crane that was inspected shall always be available for review by Contracting Officer personnel.

m. Written reports listing the load test procedures used along with any repairs or alterations performed on the crane shall be available for review by Contracting Officer personnel.

n. Certify that all crane operators have been trained in proper use of all safety devices (e.g. anti-two block devices).

### 3.4 EXCAVATIONS

The competent person shall perform soil classification in accordance with 29 CFR 1926.

#### 3.4.1 Utility Locations

Prior to digging, the appropriate digging permit must be obtained. All underground utilities in the work area must be positively identified by a private utility locating service in addition to any station locating service and coordinated with the station utility department. Any markings made during the utility investigation must be maintained throughout the contract.

#### 3.4.2 Utility Location Verification

The Contractor must physically verify underground utility locations by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within three feet of the underground system. Digging within 0.061 m (2 feet) of a known utility must not be performed by means of mechanical equipment; hand digging shall be used. If construction is parallel to an existing utility the utility shall be exposed by hand digging every 30.5 m (100 feet) if parallel within 1.5 m (5 feet) of the excavation.

### 3.4.3 Shoring Systems

Trench and shoring systems must be identified in the accepted safety plan and AHA. Manufacture tabulated data and specifications or registered engineer tabulated data for shoring or benching systems shall be readily available on-site for review. Job-made shoring or shielding shall have the registered professional engineer stamp, specifications, and tabulated data. Extreme care must be used when excavating near direct burial electric underground cables.

### 3.4.4 Trenching Machinery

Trenching machines with digging chain drives shall be operated only when the spotters/laborers are in plain view of the operator. Operator and spotters/laborers shall be provided training on the hazards of the digging chain drives with emphasis on the distance that needs to be maintained when the digging chain is operating. Documentation of the training shall be kept on file at the project site.

## 3.5 UTILITIES WITHIN CONCRETE SLABS

Utilities located within concrete slabs or pier structures, bridges, and the like, are extremely difficult to identify due to the reinforcing steel used in the construction of these structures. Whenever contract work involves concrete chipping, saw cutting, or core drilling, the existing utility location must be coordinated with station utility departments in addition to a private locating service. Outages to isolate utility systems shall be used in circumstances where utilities are unable to be positively identified. The use of historical drawings does not alleviate the contractor from meeting this requirement.

## 3.6 ELECTRICAL

### 3.6.1 Conduct of Electrical Work

Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Positive cable identification must be made prior to submitting any outage request for electrical systems. Arrangements are to be coordinated with the Contracting Officer and Station Utilities for identification. The Contracting Officer will not accept an outage request until the Contractor satisfactorily documents that the circuits have been clearly identified. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator will be allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method. When working in energized substations, only qualified electrical workers shall be permitted to enter. When work requires Contractor to work near energized circuits as defined by the NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves with leather protective sleeves, fire retarding shirts, coveralls, face shields, and safety glasses. In addition, provide electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA.

### 3.6.2 Portable Extension Cords

Portable extension cords shall be sized in accordance with manufacturer ratings for the tool to be powered and protected from damage. All damaged extension cords shall be immediately removed from service. Portable extension cords shall meet the requirements of NFPA 70.

### 3.7 WORK IN CONFINED SPACES

The Contractor shall comply with the requirements in Section 06.I of USACE EM 385-1-1, OSHA 29 CFR 1910.146 and OSHA 29 CFR 1926.21(b)(6). Any potential for a hazard in the confined space requires a permit system to be used.

-- End of Section --

## SECTION 01 57 20

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT FOR DESIGN BUILD  
02/03

## 1.1 GOVERNMENT POLICY

Government policy is to apply sound environmental principles in the design, construction and use of facilities. As part of the implementation of that policy the Contractor shall: (1) practice efficient waste management when sizing, cutting, and installing products and materials and (2) use all reasonable means to divert construction and demolition waste from landfills and incinerators and to facilitate their recycling or reuse.

## 1.2 MANAGEMENT

The Contractor shall take a pro-active, responsible role in the management of construction and demolition waste and require all subcontractors, vendors, and suppliers to participate in the effort. Construction and demolition waste includes products of demolition or removal, excess or unusable construction materials, packaging materials for construction products, and other materials generated during the construction process but not incorporated into the work. In the management of waste consideration shall be given to the availability of viable markets, the condition of the material, the ability to provide the material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates. The Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling of waste. Revenues or other savings obtained for salvage, or recycling shall accrue to the Contractor. Firms and facilities used for recycling, reuse, and disposal shall be appropriately permitted for the intended use to the extent required by federal, state, and local regulations.

## 1.3 PLAN

A waste management plan shall be submitted within 15 days after [contract award] [notice to proceed] and prior to initiating any site preparation work. The plan shall include the following:

- a. Name of individualson the Contractor's staff responsible for waste prevention and management.
- b. Actions that will be taken to reduce solid waste generation.
- c. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas and equipment to be used for processing, sorting, and temporary storage of wastes.
- d. Characterization, including estimated types and quantities, of the waste to be generated.
- e. Name of landfill and/or incinerator to be used and the estimated costs for use, assuming that there would be no salvage or recycling on the project.

f. Identification of local and regional reuse programs, including non-profit organizations such as schools, local housing agencies, and organizations that accept used materials such as materials exchange networks and Habitat for Humanity.

g. List of specific waste materials that will be salvaged for resale, salvaged and reused, or recycled. Recycling facilities that will be used shall be identified.

h. Identification of materials that cannot be recycled/reused with an explanation or justification.

i. Anticipated net cost savings determined by subtracting Contractor program management costs and the cost of disposal from the revenue generated by sale of the materials and the incineration and/or landfill cost avoidance.

#### 1.4 RECORDS

Records shall be maintained to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. The records shall be made available to the Contracting Officer during construction, and a copy of the records shall be delivered to the Contracting Officer upon completion of the construction.

#### 1.5 COLLECTION

The necessary containers, bins and storage areas to facilitate effective waste management shall be provided and shall be clearly and appropriately identified. Recyclable materials shall be handled to prevent contamination of materials from incompatible products and materials and separated by one of the following methods:

##### 1.5.1 Source Separated Method.

Waste products and materials that are recyclable shall be separated from trash and sorted into appropriately marked separate containers and then transported to the respective recycling facility for further processing.

##### 1.5.2 Other Methods

Other methods proposed by the Contractor may be used when approved by the Contracting Officer.

#### 1.6 DISPOSAL

Except as otherwise specified in other sections of the specifications, disposal shall be in accordance with the following:

##### 1.6.1 Reuse.

First consideration shall be given to salvage for reuse since little or no re-processing is necessary for this method, and less pollution is created when items are reused in their original form. Sale or donation of waste suitable for reuse shall be considered. Salvaged materials, other than those specified in other sections to be salvaged and reinstalled, shall not be used in this project.



1.6.2 Recycle.

Waste materials not suitable for reuse, but having value as being recyclable, shall be made available for recycling whenever economically feasible.

1.6.3 Waste.

Materials with no practical use or economic benefit shall be disposed at a landfill or incinerator.

-- End of Section --

## SECTION 01 57 23.00 10

STORM WATER POLLUTION PREVENTION MEASURES  
04/06

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM D 4439	(2004) Geosynthetics
ASTM D 4491	(1999; R 2004) Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(2004) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(1991; R 2003) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	(2004) Determining Apparent Opening Size of a Geotextile
ASTM D 4873	(2002) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

## 1.2 GENERAL REQUIREMENTS

Contractor shall implement the storm water pollution prevention measures to prevent sediment from entering streams or water bodies as specified in this Section in conformance with the requirements of Section 01 57 20.00 10 ENVIRONMENTAL PROTECTION, and the requirements of the National Pollution Discharge Elimination System (NPDES) permit attached to that Section.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-07 Certificates

## Mill Certificate or Affidavit

Certificate attesting that the Contractor has met all specified requirements.

#### 1.4 EROSION AND SEDIMENT CONTROLS

The controls and measures required by the Contractor are described below.

##### 1.4.1 Stabilization Practices

The stabilization practices to be implemented shall include temporary seeding, mulching, geotextiles, sod stabilization, vegetative buffer strips, erosion control matts, protection of trees, preservation of mature vegetation, etc. On his daily CQC Report, the Contractor shall record the dates when the major grading activities occur, (e.g., clearing and grubbing, excavation, embankment, and grading); when construction activities temporarily or permanently cease on a portion of the site; and when stabilization practices are initiated. Except as provided in paragraphs UNSUITABLE CONDITIONS and NO ACTIVITY FOR LESS THAN 21 DAYS, stabilization practices shall be initiated as soon as practicable, but no more than 14 days, in any portion of the site where construction activities have temporarily or permanently ceased.

##### 1.4.1.1 Unsuitable Conditions

Where the initiation of stabilization measures by the fourteenth day after construction activity temporarily or permanently ceases is precluded by unsuitable conditions caused by the weather, stabilization practices shall be initiated as soon as practicable after conditions become suitable.

##### 1.4.1.2 No Activity for Less Than 21 Days

When the total time period in which construction activity is temporarily ceased on a portion of the site is 21 days minimum, stabilization practices do not have to be initiated on that portion of the site until 14 days have elapsed after construction activity temporarily ceased.

##### 1.4.2 Structural Practices

Structural practices shall be implemented to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Structural practices shall be implemented in a timely manner during the construction process to minimize erosion and sediment runoff. Structural practices shall include the following devices.

##### 1.4.2.1 Silt Fences

The Contractor shall provide silt fences as a temporary structural practice to minimize erosion and sediment runoff. Silt fences shall be properly installed to effectively retain sediment immediately after completing each phase of work where erosion would occur in the form of sheet and rill erosion (e.g. clearing and grubbing, excavation, embankment, and grading). Silt fences shall be installed in the locations indicated on the drawings. Final removal of silt fence barriers shall be upon approval by the Contracting Officer.

##### 1.4.2.2 Straw Bales

The Contractor shall provide bales of straw as a temporary structural practice to minimize erosion and sediment runoff. If bales are used, the bales shall be properly placed to effectively retain sediment immediately after completing each phase of work (e.g., clearing and grubbing,

excavation, embankment, and grading) in each independent runoff area (e.g., after clearing and grubbing in a area between a ridge and drain, bales shall be placed as work progresses, bales shall be removed/replaced/relocated as needed for work to progress in the drainage area). Areas where straw bales are to be used are shown on the drawings. Final removal of straw bale barriers shall be upon approval by the Contracting Officer. Rows of bales of straw shall be provided as follows:

- a. Along the downhill perimeter edge of all areas disturbed.
- b. Along the top of the slope or top bank of drainage ditches, channels, swales, etc. that traverse disturbed areas.
- c. Along the toe of all cut slopes and fill slopes of the construction areas.
- d. Perpendicular to the flow in the bottom of existing drainage ditches, channels, swales, etc. that traverse disturbed areas or carry runoff from disturbed areas. Rows shall be spaced a maximum of 4 feet apart.
- e. Perpendicular to the flow in the bottom of new drainage ditches, channels, and swales. Rows shall be spaced a maximum of 4 feet apart.
- f. At the entrance to culverts that receive runoff from disturbed areas.

#### 1.4.2.3 Diversion Dikes

Diversion dikes shall have a maximum channel slope of 2 percent and shall be adequately compacted to prevent failure. The minimum height measured from the top of the dike to the bottom of the channel shall be 18 inches. The minimum base width shall be 6 feet and the minimum top width shall be 2 feet. The Contractor shall ensure that the diversion dikes are not damaged by construction operations or traffic. Diversion dikes shall be located as shown on the drawings.

## PART 2 PRODUCTS

### 2.1 COMPONENTS FOR SILT FENCES

#### 2.1.1 Filter Fabric

The geotextile shall comply with the requirements of ASTM D 4439, and shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of ester, propylene, or amide, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistance to deterioration due to ultraviolet and heat exposure. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0 to 120 degrees F. The filter fabric shall meet the following requirements:

## FILTER FABRIC FOR SILT SCREEN FENCE

PHYSICAL PROPERTY	TEST PROCEDURE	STRENGTH REQUIREMENT
Grab Tensile	ASTM D 4632	100 lbs. min.
Elongation (%)		30 % max.
Trapezoid Tear	ASTM D 4533	55 lbs. min.
Permittivity	ASTM D 4491	0.2 sec-1
AOS (U.S. Std Sieve)	ASTM D 4751	20-100

## 2.1.2 Silt Fence Stakes and Posts

The Contractor may use either wooden stakes or steel posts for fence construction. Wooden stakes utilized for silt fence construction, shall have a minimum cross section of 2 by 2 inches when oak is used and 4 by 4 inches when pine is used, and shall have a minimum length of 5 feet. Steel posts (standard "U" or "T" section) utilized for silt fence construction, shall have a minimum weight of 1.33 pounds/linear foot and a minimum length of 5 feet.

## 2.1.3 Mill Certificate or Affidavit

A mill certificate or affidavit shall be provided attesting that the fabric and factory seams meet chemical, physical, and manufacturing requirements specified above. The mill certificate or affidavit shall specify the actual Minimum Average Roll Values and shall identify the fabric supplied by roll identification numbers. The Contractor shall submit a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the filter fabric.

## 2.1.4 Identification Storage and Handling

Filter fabric shall be identified, stored and handled in accordance with ASTM D 4873.

## 2.2 COMPONENTS FOR STRAW BALES

The straw in the bales shall be stalks from oats, wheat, rye, barley, rice, or from grasses such as byhalia, bermuda, etc., furnished in air dry condition. The bales shall have a standard cross section of 14 by 18 inches. All bales shall be either wire-bound or string-tied. The Contractor may use either wooden stakes or steel posts to secure the straw bales to the ground. Wooden stakes utilized for this purpose, shall have a minimum dimensions of 2 by 2 inches in cross section and shall have a minimum length of 3 feet. Steel posts (standard "U" or "T" section) utilized for securing straw bales, shall have a minimum weight of 1.33 pounds/linear foot and a minimum length of 3 feet.

## PART 3 EXECUTION

## 3.1 INSTALLATION OF SILT FENCES

Silt fences shall extend a minimum of 16 inches above the ground surface and shall not exceed 34 inches above the ground surface. Filter fabric shall be from a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, filter fabric shall be

spliced together at a support post, with a minimum 6 inch overlap, and securely sealed. A trench shall be excavated approximately 4 inches wide and 4 inches deep on the upslope side of the location of the silt fence. The 4 by 4 inch trench shall be backfilled and the soil compacted over the filter fabric. Silt fences shall be removed upon approval by the Contracting Officer.

### 3.2 INSTALLATION OF STRAW BALES

Straw bales shall be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another. Straw bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales in order to prevent deterioration of the bindings. The barrier shall be entrenched and backfilled. A trench shall be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. After the bales are staked and chinked (gaps filled by wedging with straw), the excavated soil shall be backfilled against the barrier. Backfill soil shall conform to the ground level on the downhill side and shall be built up to 4 inches against the uphill side of the barrier. Loose straw shall be scattered over the area immediately uphill from a straw bale barrier to increase barrier efficiency. Each bale shall be securely anchored by at least two stakes driven through the bale. The first stake or steel post in each bale shall be driven toward the previously laid bale to force the bales together. Stakes or steel pickets shall be driven a minimum 18 inches deep into the ground to securely anchor the bales.

### 3.3 MAINTENANCE

The Contractor shall maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures. The following procedures shall be followed to maintain the protective measures.

#### 3.3.1 Silt Fence Maintenance

Silt fences shall be inspected in accordance with paragraph INSPECTIONS. Any required repairs shall be made promptly. Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, the fabric shall be replaced promptly. Sediment deposits shall be removed when deposits reach one-third of the height of the barrier. When a silt fence is no longer required, it shall be removed. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall receive erosion control.

#### 3.3.2 Straw Bale Maintenance

Straw bale barriers shall be inspected in accordance with paragraph INSPECTIONS. Close attention shall be paid to the repair of damaged bales, end runs and undercutting beneath bales. Necessary repairs to barriers or replacement of bales shall be accomplished promptly. Sediment deposits shall be removed when deposits reach one-half of the height of the barrier. Bale rows used to retain sediment shall be turned uphill at each end of each row. When a straw bale barrier is no longer required, it shall

be removed. The immediate area occupied by the bales and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded in accordance with the seeding specification prepared by the Designer of Record.

### 3.3.3 Diversion Dike Maintenance

Diversion dikes shall be inspected in accordance with paragraph INSPECTIONS. Close attention shall be paid to the repair of damaged diversion dikes and necessary repairs shall be accomplished promptly. When diversion dikes are no longer required, they shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded in accordance with the seeding specification prepared by the Designer of Record.

## 3.4 INSPECTIONS

### 3.4.1 General

The Contractor shall inspect disturbed areas of the construction site, areas that have not been finally stabilized used for storage of materials exposed to precipitation, stabilization practices, structural practices, other controls, and area where vehicles exit the site at least once every seven (7) calendar days and within 24 hours of the end of any storm that produces 0.5 inches or more rainfall at the site. Where sites have been finally stabilized, such inspection shall be conducted at least once every month.

### 3.4.2 Inspections Details

Disturbed areas and areas used for material storage that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system. Erosion and sediment control measures identified in the Storm Water Pollution Prevention Plan shall be observed to ensure that they are operating correctly. Discharge locations or points shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Locations where vehicles exit the site shall be inspected for evidence of offsite sediment tracking.

### 3.4.3 Inspection Reports

For each inspection conducted, the Contractor shall prepare a report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the Storm Water Pollution Prevention Plan, maintenance performed, and actions taken. The report shall be furnished to the Contracting Officer within 24 hours of the inspection as a part of the Contractor's daily CQC REPORT. A copy of the inspection report shall be maintained on the job site.

-- End of Section --